

# ANNALS of SURGERY

A Monthly Review of Surgical Science and Practice

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# ANNALS of SURGERY

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## ISCHEMIC FAT NECROSIS\*

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FAT necrosis apart from pancreatic disease is generally considered an exceedingly rare condition, while subcutaneous fat necrosis even in pancreatic disease is rather exceptional. The following case, therefore, should be of double value and interest:

*Case Report.*—CASE I.—A. E. P., aged four weeks, was referred to the First Surgical Division of the New York Hospital on December 19, 1912, by Doctor May of the Medical Clinic, for treatment of a paralysis of the left arm and because of certain peculiar subcutaneous tumors of the neck and shoulders.

*Family History.*—Father and mother alive and well. They are Russian Poles but have lived in this country several years. Two living children, both well. One stillbirth, one infant died of summer complaint. No miscarriages. The present child and the stillbirth were instrumental deliveries. No history of syphilis or tuberculosis could be obtained.

*Present History.*—The child was born after a labor of eighteen hours duration and a very difficult and tedious instrumental delivery. It was a vertex presentation: the other details are unknown. On the second day it was noticed that the left arm was completely paralyzed and that there were marked discolorations over the neck and shoulders. These cleared up in a few days and the child appeared perfectly healthy except for the paralysis. It was strong and vigorous and took the breast well. Hospital treatment was sought because of the paralysis of the arm, the parents not having noted anything else abnormal.

*Physical Examination.*—A healthy female child weighing about eight pounds and presenting no evidence of trouble except a flaccid paralysis of the left arm and hand, probably due to birth trauma, and a very slight rash on the face. On palpation, however, a large number of subcutaneous tumors were found over the neck and shoulders, extending as high as the submaxillary region and as low as the seventh rib posteriorly. These tumor masses were of irregular shape and varying sizes from one-half cm. to five cm. in diameter, and for the most part oval in shape, although one or two were sausage-like masses. Their consistency was considerably firmer than the surrounding normal fat. There was no evidence of pain, tenderness, nor any inflammatory signs whatever. The tumors were adherent to the skin, but were freely movable on the underlying tissues. The largest masses were found over the deltoid, supra- and infraspinatus regions. Various diagnoses were considered but the one

\* Read before The New York Surgical Society, February 14, 1923.

finally accepted was multiple congenital lipomata or, possibly, some condition of unaltered embryonal fat.

Under cocaine anaesthesia an oval piece of skin and subcutaneous fat was excised from the left supraspinatus region, including a portion of one of the larger tumors. The wound was sutured and healed by primary union. The child improved rapidly while under observation, although the condition of the left arm showed no change. The multiple tumors were definitely growing smaller when the child was taken from the clinic at the end of four weeks.

*Pathologic Examination, Gross.*—The tissue removed from the shoulder consisted of skin, subcutaneous fat and a portion of one of the larger tumor



FIG. 1.—Fat necrosis, infant.

masses. Upon section, the tumor tissue was seen to be fairly sharply defined from the surrounding fat, into which it extended about one and one-half cm. in depth. The color was a dull grayish-white, harder than the normal fat, opaque and of homogeneous appearance. The diagnosis at this time was not evident, as the lesion was not unlike a new growth in appearance. Syphilis and tuberculosis were considered but some form of fat tumor was considered more probable.

*Microscopic.*—Part of the tumor tissue was immediately injected into a guinea pig and the rest was sectioned at once by Doctor Elser. Frozen sections were stained with hæmatoxylin and eosin and showed under the microscope a most beautiful picture of subcutaneous fat necrosis in a fairly advanced stage of repair, with considerable round cell infiltration and formation of new connective tissue but more especially the presence of innumerable giant cells of the irritation or foreign body. (Fig. 1.) Everywhere throughout the specimen the



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necrotic fat spaces were filled with bundles of fatty acid crystals. In other words the picture was typical of fat necrosis of the type usually considered pancreatic in origin. Sections stained and examined for bacteria showed none present. The pig into which a portion of the tissue had been introduced remained perfectly well for four months and on autopsy showed no lesions whatever.

This case is then one of the very infrequent cases of subcutaneous fat necrosis and is the only one, so far as a careful search of the literature shows, in an infant. Considering the weight and age of the child, it is also probably the most extensive case on record of fat necrosis with recovery.

Stimulated by these unusual findings and by the friendly interest of Doctor Elser, I sought to determine, so far as possible, the origin of the lesion, its frequency and the results. Inquiry was made of numerous pathologists, obstetricians and pediatricists as to similar observations, with entirely negative results, although Dr. Horst Oertel stated that he had not infrequently seen necrosis of the abdominal fat in obese subjects, following laparotomy. Through the kindness of Dr. Edward Truesdell, forty new-born infants were examined at the New York Lying-in Hospital, again with negative findings. It should be observed, however, that none showed evidence of severe traumatism at birth.

Through the courtesy of Professors Elser and Ewing, the attempt was then made to reproduce experimentally the lesions of fat necrosis, by traumatism, in the Laboratory of Surgical Pathology of the Cornell University Medical School.

*Experiment I.*—Sterile normal subcutaneous fat obtained at operation for inguinal hernia in a young child was divided into two portions. One part was placed in a thermostat at 37 C. for two days. At the end of this time, smears in a drop of water showed fairly numerous crystals of fatty acid. The second portion was kept in two per cent. formol at room temperature for 25 days, at the end of which period smears both from the surface and from the interior showed very numerous crystals of fatty acid.

*Experiment II.*—The repetition of the above, using fat from an obese old lady and keeping it ten days at 37 C. Smears showed almost complete change into fatty acid crystals and fine fat droplets.

From these two simple procedures, which of course are not original, it may be concluded that fat is a very unstable substance and that it readily splits into fatty acid and glycerine without any extraneous aid. It should be noted that no macroscopic blood was present in the fat. The presence of a fat splitting ferment in the blood as well as in the fat itself has long been known.

*Experiment III.*—A healthy female pig about six weeks old and weighing about twenty pounds was then obtained; its shoulders shaved and the skin and subcutaneous fat traumatised in seven places by means of strong pincers, whose jaws were guarded with rubber to prevent abrasion of the skin proper. A piece of normal skin and subcutaneous tissue was removed as a control as well as one of the traumatised areas. The other pieces of traumatised tissue were removed at subsequent periods as shown below.

(a) Piece of normal fat—careful examination of smears showed no crystals. No evidence of necrosis. This tissue was then placed in 10 per cent. formol and

kept at room temperature for 28 days. A smear from surface scraping then showed an occasional typical fatty acid crystal. From this it may be concluded that fat splitting can take place to a slight extent even in the presence of a powerful antiseptic, and is presumably then not a biochemical phenomenon.

(b) The traumatised piece of tissue removed immediately was examined at once by scrapings, and showed only fine oil droplets and fat cells. There were no crystals. Placed in 10 per cent. formol and kept at room temperature 30 days it showed fairly numerous fat crystals in the smears. No evidence of necrosis.

(c) Tissue removed 48 hours after traumatism showed only oil droplets in finely divided state and no crystals. No evidence of necrosis although fat seemed softer than normal. Again examined at the end of 28 days in 10 per cent. formol, a very few typical crystals were found after prolonged searching.

(d) Tissue removed in four days with exactly the same findings. At the end of 26 days fairly numerous fatty acid crystals were found in scrapings. No evidence of necrosis.

(e) Tissue removed at the end of 6 days showed in one place a brownish discoloration nearly a centimeter in diameter, evidently a spot of hemorrhage and necrosis. Scrapings made at once from the normal appearing fat showed no crystals, but at the end of 24 days fairly numerous fatty acid crystals were found in the same tissue. The stained sections will be described later.

(f) Tissue removed 8 days after the traumatism. No evidence of necrosis. Fatty acid crystals were not found at once, but were very numerous in the scrapings at the end of 22 days.

(g) Tissue removed at the end of 14 days. Gross appearance not markedly different from the others. Scrapings taken immediately showed no fatty acid crystals. No evidence of necrosis. At the end of 16 days numerous crystals were found.

(h) A piece of tissue including the suture line of one of the first incisions was removed at the same time as specimen (g). Necrosis was present around the sutures (which were of horse-hair and had been in place about two weeks). No evidence of infection. Scrapings from about the suture marks showed numerous typical fatty acid crystals.

It should be observed in explanation of the somewhat irregular and inconstant findings above, that the writer was quite inexperienced in laboratory technic, and that the traumatism inflicted was of a very mild and inconstant nature. The rubber guarded jaws tended to slip easily on the somewhat greasy surface of the pig's skin and the amount of pressure exerted was not severe and was quite irregular. Moreover, although the traumatised places were marked with carbol fuchsin, the stain faded fairly soon, and not improbably the places really traumatised were not excised at times.

*Experiment IV.*—With the pig under deep ether anaesthesia, a piece of skin and subcutaneous tissue was squeezed firmly with the guarded pincers for about five minutes, and carefully marked. At the end of 26 days this piece was excised and a small but distinctly indurated mass could be felt in the centre. On section, a thin-walled cyst was seen, the size of a grain of wheat, and, closely adjacent, a slightly larger area of typical fat necrosis, dull grayish-white in appearance, opaque and somewhat firmer than the surrounding fatty tissue. Scrapings showed numerous fatty acid crystals.

Frozen sections were made from the tissue (e) Experiment III, and from the specimen removed in (d), and stained in various ways, hæmatoxylin and eosin, Nile blue, Benda's stain, Sudan III, etc., and showed typical fat necrosis in each. The section from (e) was of course at a much earlier stage

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and showed considerable interstitial hemorrhage: innumerable fatty acid crystals appeared in the necrosed cells and only a moderate tissue reaction (6 days duration), with no typical giant cells.

The section from Experiment IV, after 26 days, showed a thin-walled recent cyst, lined with connective tissue only, and close by an area of marked tissue reaction, new formed fibrous tissue, very numerous giant cells of the irritation or foreign body type, and considerable round cell infiltration. Fat in all stages of cellular necrosis was beautifully shown by the various stains. Innumerable crystals of fatty acid were everywhere present in this area, usually

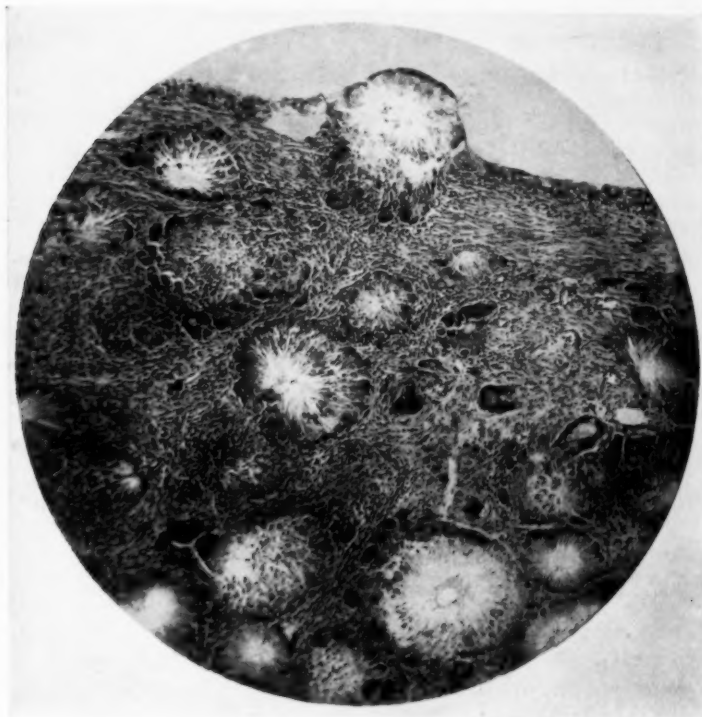


FIG. 2.—Fat necrosis, pig.

in the fat cells. There were other amorphous areas, rather deeply stained with hæmatoxylin, which were apparently calcium soaps of the fatty acids. No calcification proper was seen. (Fig. 2.)

A number of the various specimens removed were blocked in paraffin and sectioned and stained in various ways, but with the exception of the two places mentioned above, only doubtful evidence of true fat necrosis was seen.

It is only just to the pig to state that he remained perfectly well throughout the experience, all his small wounds healed by primary union, and he doubled in weight in the seven weeks he was under observation.

It may be concluded from the above that fat necrosis is rather easily produced by simple trauma, and that fat necrosis and fat splitting are two quite different processes, frequently allied, to be sure, but not necessarily so. Necrosis is the principal event, fat splitting being only an accompaniment and

probably readily occurring independently in the living or dead fat cell. Certainly in the case reported and in the experimental work one can safely exclude any pancreatic disease, or any infectious process in the fat. This leaves two possible theories of causation, (1) enzyme action from liberated blood or from the fat cell itself, (2) simple pressure necrosis from anemia with secondary fat splitting. Probably both factors take part in the process, but it is not necessary to postulate enzyme action at all for its production.

An attempt was made to determine the activity of enzyme reaction in the presence of such a strong antiseptic and germicide as formalin in 10 per cent. solution. Ethyl butyrate was chosen as the agent and glycerole extract of pancreas for the enzyme. Experiments were conducted as follows:

- A. 1. Ten c.c. H<sub>2</sub>O plus 1 c.c. E. B. plus two drops litmus plus NaOH n/100 qs. ad alkalinity (2/10 c.c.).
  2. Ten c.c. H<sub>2</sub>O plus 2 drops litmus plus NaOH n/100 qs. alkalinity plus pancreas extract, drops 3.
  3. Ten c.c. formol (10 per cent.) plus c.c. E. B. plus litmus plus 3 drops pancreas extract plus NaOH n/100 qs.
  4. Ten c.c. formol (10 per cent.) plus 1 c.c. E. B., litmus, plus NaOH n/100 qs.
- These four solutions were placed in a thermostat at 37 degrees C. and observed at various periods for 24 hours.

All remained alkaline in reaction except No. 2, which showed a strong acid reaction at the end of 21 hours. This experiment was repeated three times to insure accuracy, the results being identical at each trial.

- B. Using saliva and soluble starch for the reagents, the following experiments were conducted:—

1. Saliva plus H<sub>2</sub>O plus starch.
2. Saliva plus formol (20 per cent.) in equal volume plus starch. These were incubated at 37 degrees C. In (1) at the end of 45 minutes there was a slight reduction to Fehlings. In 20 hours there was a heavy reduction to Fehlings, a nearly complete reduction, with slight formation on erythro- and achroödextrin.

In (2) at the end of 45 minutes, there were slight reduction to Fehlings and considerable erythro- and achroödextrin but no glucosazone. It was then found that formol itself would reduce Fehlings and the tests were therefore repeated, using formol and starch, and formol, starch and saliva respectively. Benedict's test for sugar was negative in each, at the end of 20 hours.

Similar tests were conducted with milk, pancreas extract and formol (10 per cent.); with ethyl butyrate, pancreas and formol, etc., and the results were identical in each test—namely, that formol in 10 per cent. solution inhibits the action of the fat splitting enzyme of the pancreas, and the ptyalin of the saliva.

From these experiments it seems fair to conclude that the fat splitting repeatedly observed to occur in the presence of 10 per cent. formol solution is not due to enzyme action, but to the fact, that fat is very unstable and easily breaks down into its constituent fatty acids and glycerole. The weak point in the argument, of course, is that the surface film of oil on the specimens would prevent the full action of the formol on the tissue enzymes. As, however, the pieces of tissue used were very small and as the surface scraping in each instance showed fatty acid crystals, this objection is not a very strong one.

The ultimate fate of these foci of necrosis is of considerable interest.



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Korte, at a cholecystotomy found a widespread intra-abdominal fat necrosis, while at a subsequent laparotomy for common duct stones, a year later, no trace of it was to be seen. On the other hand, Lubarsh and Ostertag found that such foci usually calcified just as the fatty acids in old tuberculous foci, in cysts, etc., calcified. In this connection a recent observation of Webber is of interest: A seven year old girl presented multiple calcified foci in the subcutaneous fat of the trunk and extremities. New ones had formed during the past year. The von Pirquet and Wassermann tests were negative and microscopical examination of an excised fragment showed only calcareous material with no tuberculous nor luetic involvement. Although Webber does not establish a certain diagnosis, this would appear to be a case of multiple subcutaneous fat necrosis of unknown origin.

CASE II.—E. C., French maid, twenty-five years of age, admitted to the New York Hospital, out-patient department, Cornell division, September 27, 1913, complaining of a painful swelling in the right thigh. Her family history was negative, and the only previous illness was a severe fever of 11 days duration, a year previously in a French hospital. At that time she received hypodermics of camphorated oil, 2 in the right thigh, 1 in the left. She has had pain in the right thigh ever since, especially on becoming tired and has noticed a small swelling at the site of the hypodermic injection.

Examination revealed nothing abnormal except an indurated swelling 5 cm. in diameter and 1 cm. in depth in the middle of the antero-external surface of the right thigh, attached to the skin, but freely movable on the fascia lata. The swelling is flat, tender, not discolored, and shows no signs of inflammation. On being rolled between the fingers and thumb, it presents a typical pig-skin appearance with coarse follicles. As the condition was evidently causing no great discomfort expectant treatment was advised. Nothing has been heard from her since. The case is evidently one of subcutaneous fat necrosis by irritant chemical action. The result will probably be a cyst or calcareous deposits.

CASE III.—J. J. B., male, thirty-nine years of age, chief complaint, a painful rapidly growing swelling in the left thigh. Family history negative, previous history negative except that he has been a heavy drinker and has had "attacks of rheumatism." Present history: Thirty-five years ago, at the age of four, patient was struck by a street car, receiving a severe contusion on the left thigh. He was treated by the family physician and recovered promptly. There was no fracture. Ever since this injury, he has had a hard, painless flat swelling over the antero-external surface of the left thigh, near its middle. This caused no inconvenience nor symptoms until two months ago, when the lump was contused by falling lumber. Since then the swelling has increased in size and become very tender.

Examination revealed a vigorous, healthy working man with a swelling on the antero-external surface of the left thigh about its middle, attached to the skin, and to the fascia lata. The swelling was not discolored, but was slightly tender on manipulation. It was about 10 cm. in diameter and raised 1 cm. above the surrounding skin. It was extremely hard, evidently calcareous, except at its centre, which presented an area of fluctuation about 3 cm. in diameter. The diagnosis was in doubt as malignancy could not be excluded, but the opinion was expressed that the condition was a calcareous degeneration of a subcutaneous lipoma.

Under ether anæsthesia, April 14, 1914, the tumor was completely excised, including a large area of skin, fat, and fascia lata, which was markedly involved. The wound healed per primam and the patient has been perfectly well since. Examination of the specimen showed multiple, thick-walled cysts surrounded by dense fibrous tissue and large calcareous deposits. (Fig. 3.) The content of the cyst was a peculiar opaque, white liquid, very thick, and strikingly like white lead in appearance. In places this was replaced by semi-solid material, like caseating tuberculosis, but distinctly different in color. Microscopical examination of the cyst walls showed only old fibrous tissue and calcareous deposits. No epithelial lining could be observed. Smears made from the semi-solid areas

showed innumerable cholesterol crystals and other amorphous substances, evidently calcium soaps. On treating this substance with strong sulphuric acid, followed by iodine, the cholesterol took on its characteristic purple stain, while the soaps were broken up and fatty acid crystals in great abundance were precipitated.

This case is undoubtedly one of subcutaneous fat necrosis by trauma, resulting in cyst formation and calcareous degeneration. There were no evidences of syphilis, tuberculosis, nor malignant disease.

The three cases described, present three stages in the same disease. All occurred in young subjects with abundance of subcutaneous fat. The infant showed necrosis of tissue with fat splitting and the early stage of tissue reaction, innumerable giant cells and beginning fibrous tissue replacement. The conditions present in the young girl, a year after the chemical trauma, are only conjectural, but probably would show large deposits of calcium soaps and marked new formation of fibrous tissue. Case III shows the end result of subcutaneous fat necrosis, with cyst formation, calcareous deposits and masses of cholesterol and calcium soaps.



FIG. 3.—Case II. Fat necrosis, adult.

CASE IV.—F. G., fifty-three years of age, farmer, operated upon in the service of Dr. Alfred Taylor at Fordham Hospital for a large paraumbilical hernia of many years' duration. The family and past history were negative and the hernia was reducible until recently. There had been no injury, or history of abdominal disease. The patient was very obese but otherwise in robust health. At operation, a moderately large omental hernia was found and in the protruding portion just at and outside the ring, were three small calcareous nodules embedded in the fat tissue. The largest was 1 5/10 cm. in greatest diameter. These three nodules were removed and examined with the following results:—Calcium was present in considerable quantity. Carbonates in small quantity. There were also fatty acid crystals, oil droplets, and amorphous bodies, probably soaps. Quantitative analysis by the sulphuric acid—ether extraction showed nearly 30 per cent. of the calculi to consist of fatty acid while soaps were present in considerable amount.

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There can be no doubt that this is a case of fat necrosis, but the origin of it is not absolutely clear. In all probability the frequently repeated trauma of passage through the ring and pressure of external objects during heavy labor caused the necrosis, but partial strangulation at the ring cannot be excluded. Pancreatic disease is of course a possibility but not probable. Calcareous degeneration of appendices epiploicæ is not very uncommon, presumably following a fat necrosis of mild degree but not of traumatic origin.

CASE V.—Female, about thirty years of age, admitted to the service of Dr. I. S. Haynes, in the Harlem Hospital, and examined by me through his courtesy. There was a history of severe trauma to the right thigh, about 6 weeks previously, followed by a slightly painful swelling in the subcutaneous fat, just above the knee. This swelling was of a peculiar sausage shape, was somewhat tender, attached to the skin, but not to the fascia lata. It was partly excised by Doctor Haynes and pronounced a sarcoma by a competent pathologist. But further examination proved it to be merely an extensive area of fat necrosis with typical giant cells, fat crystals etc. Reproduction of fatty and fibrous tissue was quite pronounced.

CASE VI.—O. E., female, thirty-eight years of age, entered the Cornell or First Surgical Division of the New York Hospital, March 3, 1917, complaining of a painful series of subcutaneous tumors in the right deltoid region. The only history we could obtain, was that following a miscarriage three years ago, in Greece, a midwife gave her a hypodermic injection of some medication, possibly quinine. There was no immediate reaction except slight induration but later marked induration and pain followed. Examination showed a well nourished woman with no abnormalities, except two or three small, hard, subcutaneous nodules about one centimeter in diameter in the subcutaneous fat over the insertion of the right deltoid muscle. They were not adherent to the muscular aponeurosis but were tender. Manipulation of them seemed to cause considerable pain, radiating to the fingers, two of which were slightly swollen. These masses were excised under anæsthesia and examination proved them to consist of many large and small cysts, containing clear oily fluid in fine droplets. Scrapings showed small numbers of fatty acid crystals, but there was no acid reaction.

This case is of doubtful nature and possibly should not be classed as fat necrosis. It may be that we have here an example of encysted oil collections from injections of camphorated oil or liquid petrolatum.

CASE VII.—D. G., female, about thirty-five years of age, entered the Cornell division of the New York Hospital, in November, 1919, complaining of a small subcutaneous tumor on the posterior surface of the right arm about two inches above the elbow. She gave a history of a rather severe blow in that region five years previously, followed by considerable discoloration. A lump formed which has persisted ever since. Examination showed a stout, healthy, young woman, with a hard, probably calcareous nodule in the subcutaneous fat over the right triceps. It was only slightly tender, and scarcely if at all attached to the skin. This mass was excised by Dr. Kenneth Johnson of the Staff and healing was uneventful. Examination showed an encysted tumor mass almost completely calcified and containing some grayish-white material, similar to that observed in other cysts of this nature. Degeneration was so complete that the microscopic examination was very unsatisfactory. A completely calcified simple epidermoid cyst could not be excluded. Another confusing factor was the presence of two apparently similar but smaller calcareous nodules in the neck which would ordinarily have been classified as calcified cervical lymph-nodes, probably tuberculous in origin.

About a dozen other similar cases have been observed during the past seven years. All were recent in origin, due to fairly severe trauma and occurred in young, robust, and stout subjects. The tumor masses lasted for periods up to three months and then gradually disappeared or the patients no longer returned for observation. As these masses were causing no active symptoms, operative intervention was deemed unnecessary. There is little doubt, however, that in most of them we were dealing with traumatic subcutaneous fat necrosis of mild degree.

Such cases must be of fairly common occurrence and since the calcareous cysts described above are quite uncommon it must be that the great majority of them undergo spontaneous resolution and complete healing.

Subcutaneous fat necrosis is of little importance in itself, as its end results are either complete resolution or the formation of fibrous walled and calcareous cysts. The chief interest attached to the masses is that of differential diagnosis. The recognition of the possibility of fat necrosis in subcutaneous tissue is important and should be borne in mind along with the lipomata, neuromata and the granulomata. They will only rarely require surgical attention. The relation of traumatic fat necrosis to pancreatic fat necrosis may prove of considerable importance and is worthy of investigation. Its relation to cyst formation and possibly to true tumors should also be kept in mind.

Fat necrosis is therefore probably far more common than is suspected, in the brawny contusions of obese subjects, in broken-down lipomata, etc., and especially in operative wounds. Here it unquestionably must be a large factor in causing induration and probably also infection, as the presence of a foreign body, wherever found, favors the development of infection.

A number of cases of ischaemic fat necrosis, or better necro-biosis, have been shown. It has been proved comparatively easy to reproduce the condition in animals. No pancreatic disease or injury is necessary for the process of fat necrosis. Possibly no ferment action is concerned, the etiological factor being simply ischaemia. It is difficult to understand why fat necrosis in adipose children and in new-born infants is not extremely common. There probably is some other underlying factor which has been overlooked.

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## THE SIGNIFICANCE OF DIARRHŒA FOLLOWING ABDOMINAL OPERATIONS \*

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THERE are very few more startling and dramatic experiences in the after-care of a surgical condition than the sudden and unheralded development of a complication that overwhelms a patient who, to all appearances, has been making an excellent recovery from a serious disease. It is most fortunate that severe diarrhœas develop very rarely during a smooth convalescence, in patients operated upon for intra- or extraperitoneal diseases of the abdominal organs, all the more so as these diarrhœas may be completely uncontrollable and lead to the death of the patient.

Consider a long-suffering patient who has been operated upon for ulcer or carcinoma of the pylorus, either a pyloroplasty with excision, or a gastro-jejunosomy, or a resection, as the case may be, being done; he comes out of the first few days nicely and rapidly recovers what seems to be a normal condition. Everything is serene, when suddenly, with or without pain, with or without a rise in temperature, in the beginning of the second week a diarrhœa sets in which may rapidly become uncontrollable. Until this complication develops, an uneventful convalescence is taking place. At first one ignores the diarrhœa, but in twenty-four hours one realizes it is a serious and threatening complication, and if uncontrolled, the patient rapidly succumbs. Or again, imagine a patient suffering from a perforated gastric ulcer with beginning general peritonitis; he is operated upon, the perforation is closed. Rapidly he comes out of shock, all his symptoms of peritonitis disappear, he is taking nourishment, and by the end of the first week convalescence is well under way. Suddenly into this quiet picture a new and mysterious development obtrudes itself in the shape of a diarrhœa. Again, at first one is not alarmed, but within twenty-four to forty-eight hours, the uncontrollable diarrhœa saps the patient's strength, and within a few days, rapid wasting sets in and the patient dies, presenting the well-recognized picture of a case of acute cholera, unless the cause of the diarrhœa is discovered and eliminated. Fortunately, as I have said, these startling complications are most exceptional. Some ten years ago I saw such a case and ever since then I have been keenly interested in this condition and have attempted to study this complication, attacking the problem from various angles in the hope that I might arrive at a better and clearer understanding of the causation and of the treatment. The results of this very incomplete study are herewith presented.

Before going any further, I wish to make it clear that I am not referring to diarrhœas that are the result of overcatharsis, or due to overuse of enemata,

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etc., nor to those caused by the flaring up or a relapse in cases of bacillary or amœbic colitis.

The literature on this subject up to date has been very scanty, though of late more references to this complication are beginning to appear. Continental writers have given more attention to this complication than the English speaking profession. Both groups have seen diarrhœas in cases of gastric or duodenal ulcers, as well as in cases of gastric cancer following operation. Perhaps A. Carle and G. Fantino<sup>1</sup> were the first to report on this condition. Case 73 of their series was a pylorectomy with gastro-enterostomy in a cachectic patient. A fatal diarrhœa developed. Autopsy showed a gastro-enteritis which they attributed to intoxication caused by chloroform anæsthesia and dyspepsia. Kelling<sup>2</sup> calls attention to the diarrhœas, usually mild, occasionally severe, coming on in the first days after gastro-enterostomy, and believes they are due to hydrochloric acid irritation of the intestinal mucosa. He suggests that some may be due to abnormal fermentation in cases with no acid, and these are a much less dangerous type. W. Anschuetz,<sup>3</sup> having lost two cases within a year with fatal diarrhœas following gastric operations, attempted a complete study of this complication. Both of these cases had convalesced normally to the seventh and tenth days, respectively, when uncontrollable diarrhœa set in. The complication was most uncanny and startling. He refers to Terrier and Hartman, as well as Monprofit, who attribute the condition to resorption of putrefactive materials or irritation of the small gut after the relief of pyloric obstruction. W. Anschuetz saw in all, close to a dozen cases beginning between the sixth to the tenth days after operation for benign or malignant conditions of the stomach, and at least five of these were fatal. Three cases came to autopsy; they showed no peritonitis. In three cases there were ulcers in the colon and in the rectum with diphtheritic colitis or proctitis. In reviewing five hundred gastric operations, he found about thirty cases of post-operative diarrhœa, a percentage of these apparently inexplicable. Of these thirty, there were seven gastro-enterostomies for carcinoma with four deaths, and four resections or pyloroplasties with one death. In his experience, this complication occurs after typical gastro-enterostomy with short loop, with stoma too low in jejunum, and also after reestablishment of normal continuity (Billroth I). Anschuetz is inclined to believe that too rapid emptying of stomach through the stoma and the weakened condition of the patient favor the development of the diarrhœa. Dietary errors may contribute, Anschuetz admits, as in a case reported by Stich, but usually are not the cause. He has seen it when the gastric juice was not acid, when there was no fermentation, and when the stoma was not too low in the small intestine. G. Durand<sup>4</sup> has noted early development of diarrhœa in over twelve per cent. of stenosing ulcer cases after gastro-enterostomy. He attributes it to too early return to normal diet and to purgation. It may be transient or last for months; it may be continuous or intermittent; each recurrence following errors in diet or fatigue. It may begin months after operation, and the prognosis in his cases was almost regularly favorable. He believes

that nervous influences in addition to large stoma with rapid emptying are the underlying causes. These mild cases seem to be in a different class, and perhaps pathologically quite different from those studied in this paper. A. Mathieu and R. Savignac<sup>5</sup> have seen such mild cases as just referred to as well as the severe and fatal cases. These latter they have seen in cachectic malignant disease and the complication has been acute. Too rapid emptying, they believe, has a causative relation to the development of the diarrhoea. H. Paterson<sup>6</sup> also calls attention to this condition and, referring to previous writers on this subject, says he has seen it only twice and that he thought it due to intestinal toxæmia and relievable by calomel. Moynihan<sup>7</sup> says he has seen only one case, in whom the diarrhoea lasted five days and patient recovered. He concludes from his study of the literature that "it is apparent that no adequate explanation of this complication can be given." Jonas'<sup>8</sup> study of gastrogenous diarrhoeas should be mentioned here. From a study of cases of achylia, hyperacidity and extreme gastroparesis, he concludes that when the pylorus is unduly permeable, there is a predisposition to diarrhoea, while with defective motor functioning of the stomach and intestines, there is unduly long pyloric closure. These observations, from a totally different angle, lend some support to the influence of a too large stoma. More recently, Troell<sup>9</sup> has reported eleven cases of this complication in ulcer patients; four after gastro-enterostomy; three after sleeve resections; three after pyloric exclusion and gastro-enterostomy, and one after segmental resection and gastro-enterostomy. Key has also seen this complication and emphasizes the fact that it may be fatal. In 1920, F. Bierende<sup>10</sup> reported seven post-operative cases with proctitis and colitis coming on from two to six days after operation. In six cases there was peritonitis, and in the seventh case there was suppurative paranephritis. Four of these patients had operations in the upper abdomen or stomach, and three had laparotomies for other conditions; all died. He believes there is a primary circulatory disturbance (vaso-paralysis) which allows of the development of the proctitis or colitis. He calls attention to the fact that Wertheim encountered this condition occasionally in his radical operations for carcinoma of the cervix. W. Goldschmidt and A. Muellender<sup>11</sup> review two hundred seventy-three stomach operations with three fatal cases due to diarrhoea. Ten cases developed this complication. The three that succumbed were evidently bad risks.

CASE I was a gastro-enterostomy for carcinoma who developed eleven days after operation bloody diarrhoea with bacillus coli and bacillus fecalis alkaligenes. Autopsy showed acute necrotic ileocolitis and general cachexia. CASE II was a subtotal resection for carcinoma. Diarrhoeas began one day after operation. Bacteriological examinations were negative. Autopsy showed diphtheritic ileocolitis. CASE III was an exclusion and gastro-enterostomy. Diarrhoea began six days after operation. Autopsy showed ulcerative ileocolitis. The authors say that they have seen the same complication in fracture of the spine (two cases) and in brain tumors (three cases). The clinical picture resembles dysentery without the specific bacilli.



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From this brief review of the literature, it is apparent that the cause of the diarrhœas is not clear. I believe we can dismiss those mild and usually transient cases that are mentioned by some of the authors and appear to follow too early changes to full or improper diet, overeating or purgation. The explanation based on chloroform anæsthesia can also be dismissed. Can we, however, dismiss too rapid emptying through too large or even a proper sized stoma? Originally, I thought this might be the best explanation until I encountered this complication in a case of perforated ulcer, in which the ulcer alone was repaired and no gastro-enterostomy performed. Moreover, cases have been reported in the literature following pyloroplasty and reestablishment of normal continuity. A review of the cases already reported would suggest a variety of possible causes. It seems most likely that a terminal infection in a cachectic patient would explain many of the published cases. Perhaps a renal insufficiency may contribute to this, as it is well known that the type of colitis reported above is very similar to that seen in chronic nephritis. However, it would seem that such cases as reported by Bierende and Wertheim belong in another group. While the chance of controlling the diarrhœa in the former group may be slight, in the latter group, if one is on the lookout, it is just possible that the serious complication may be controlled.

Before analyzing the situation any further, let me briefly describe five fatal cases that have been encountered by the writer during the last ten years:

CASE I.—M. B., male, thirty-five years, June 6, 1912. Bellevue Hospital. Alcoholic. Diagnosis: Perforated duodenal ulcer and peritonitis. Operation about thirty-six hours after onset. Perforation closed. No loop posterior gastrojejunostomy; cigarette drain in upper angle of wound. Patient developed pulmonary signs suggesting consolidation. Urine contained hyaline casts. Five days after operation, while patient was apparently doing well on a very simple diet, diarrhœa set in. At first no alarm was felt, but when despite castor oil, followed by bismuth and colon irrigations, the diarrhœa became more severe and the temperature, which at first rose, became subnormal, it became clear that the patient would die unless we ascertained the cause and gave relief. We became thoroughly alarmed by this unexpected complication. After thirteen days of uncontrollable diarrhœa, the patient died. No cause was found clinically, and no autopsy allowed.

CASE II.—P. B., male, fifty-six years. April 2, 1914, to April 15, 1914. Bellevue Hospital. Diagnosis: Perforated duodenal ulcer and peritonitis. Operation about twenty-four hours after onset. Perforation closed. Pyloric exclusion with linen, posterior no loop gastrojejunostomy. Tube drainage in angle of incision. Uneventful recovery until diarrhœa set in on the eighth day with temperature. Coincident with this in right iliac fossa, tenderness and rigidity developed but no definite mass. The diarrhœa became uncontrollable. Patient rapidly collapsed and died about five days after the onset of the diarrhœa. After death the right iliac fossa was aspirated to determine the presence of a secondary abscess, and pus obtained. No autopsy allowed.

CASE III.—I. A., male, fifty years. February 7, 1915, to February 17, 1915. Mt. Sinai Hospital. Diagnosis: Perforated duodenal ulcer and peritonitis. Operation within twenty hours of onset. Perforation closed. Drain in angle of incision. Uneventful recovery until fourth day, when diarrhœa set in. Patient

rapidly wasted away with uncontrollable diarrhoea and died six days later. Here, too, the temperature gradually rose with the development of the diarrhoea. The urine showed albumen and granular casts. No secondary abdominal suppurating focus could be detected. No autopsy allowed.

CASE IV.—P. F., male, fifty-two years. February 9, 1917, to February 23, 1917. Bellevue Hospital. Diagnosis: Perforated gastric ulcer and peritonitis. Immediate operation. Suture of perforation. Uneventful recovery until fifth day when diarrhoea set in. This continued for nine days, was uncontrollable, and patient died. No autopsy allowed.

CASE V.<sup>12</sup>—C., male, forty years. September 12, 1922, to September 25, 1922. Bellevue Hospital. Diagnosis: Perforated gastric ulcer and peritonitis. Operation within seventeen hours of onset. Perforation in stomach sutured. Uneventful recovery until seventh day when temperature rose and uncontrollable diarrhoea set in. Indefinite mass developed in right iliac fossa, which was opened and pus drained. Patient developed pericarditis, became more and more emaciated and died thirteen days after operation. Autopsy not allowed.

Here we see five cases of perforated ulcers with peritonitis, in which an uncontrollable and apparently inexplicable diarrhoea developed during a satisfactory convalescence. In two, an anastomosis had been made, and in three, only a closure of the perforation. It is apparent that in these cases the explanation based on rapid emptying through the stoma is not applicable, even should it have a causative relation in some of the cases. It is most unfortunate that no autopsies were obtained. Evidence was developed after death in Case II pointing to a pericæcal exudate, and in Case V a similar condition obtained. Does such a pericolic or pericæcal suppuration throw any new light on this obscure subject?

Let us investigate this last point a little further and look at the whole subject from a different angle. It is evident from these cases that the explanation of the diarrhoeas in these cases may be quite different from that underlying many of the reported cases. In those that came to autopsy in W. Anschütz's series, no suggestion of pericolic abscess, or localized peritonitis, was made; while in the cases reported by Bierende and others, involvement of the peritoneum was a frequent occurrence. For many years I have noticed that diarrhoea may set in after an operation for acute appendicitis and it almost regularly means a localized pericolic abscess. Why some patients develop such abscesses and have no diarrhoea, is not evident. Nevertheless, the development of diarrhoea in such cases I believe most significant, and the fact that the diarrhoea ceases on drainage of the local suppurative peritonitis confirms the casual relationship.

Without making an extensive review of the available records, as I have observed this coincidence many times, I have recently looked into the records of some two hundred fifty cases of acute suppurative appendicitis with or without gangrene of the appendix, with local or general peritonitis, and I have found that diarrhoea developed in the convalescence of six cases and was in each instance relieved by drainage of an intraperitoneal abscess. The type of diarrhoea, it must be admitted, was less severe than that seen in the gastric cases referred to above, but that might be explained by the youth and the

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resistance of the patients as well as by the brief period of illness of these cases. Once I saw this same complication in an interval case which is well worth mentioning briefly:

Mrs. L. K., Mt. Sinai Hospital, thirty-one years. Diagnosis: Chronic appendicitis with gastric symptoms suggesting ulcer. At operation, a rectoæcal appendix was removed and stump not inverted. The base of the appendix was well up on the posterior cæcal wall and when the loose cæcum was allowed to fall back into its position, it blocked the approach to the base of the appendix so that the omentum could not reach it and form the usual protective adhesions. At operation there was visible pylorospasm as well as antral spasm. The patient made a satisfactory convalescence, all reflex gastric symptoms being relieved until the fifth day when temperature rose to 103.8; reflex gastric symptoms, tenderness, and a mass in the right iliac fossa developed accompanied by marked diarrhœa. This condition continued for five days when suddenly, with the rupture of the retro-cæcal abscess into the cæcum, the mass, the tenderness, the temperature and the diarrhœa disappeared, as well as the reflex gastric symptoms.

Similar cases associated with diarrhœa are seen every once in a while previous to operation when the retrocæcal, chronically inflamed appendix is complicated by a localized typhlitis with thickening of the cæcal wall. Recently I saw such a case. It was difficult to decide whether we were dealing with a dysentery and appendicitis or only the latter.

Although these intraperitoneal abscesses usually follow intraperitoneal operations, rarely extraperitoneal procedures may be followed by this complication, and in the following case such an intraperitoneal suppuration produced marked diarrhœa:

L. K., nineteen years, Mt. Sinai Hospital. Diagnosis: Right pyonephrosis; nephrotomy and drainage followed by nephrectomy when condition had improved. About eight days after nephrectomy there developed a violent diarrhœa with low temperatures (maximum 100.2). The diarrhœa was almost uncontrollable with ordinary drugs, and it was only after we found an indefinite mass in Douglas' pouch extending into the left iliac fossa that we recognized the cause of this unusual complication. As the abscess in Douglas' pouch became more evident, it was incised and drained through the rectum, and the patient's diarrhœa ceased and he made a complete recovery.

It is evident from this brief account that if diarrhœa sets in after operations on the abdominal viscera, it is our duty to search for such pericolic abscesses and drain them. How often they are present and unrecognized when diarrhœa is the dominant symptom in the clinical picture, time alone, with further experience, will tell. The literature may have placed too great an emphasis on the rapid emptying through too large a stoma, ignoring such possibilities as just mentioned.

### CONCLUSIONS

1. Diarrhœa may follow any operation on the intraperitoneal or extraperitoneal abdominal organs.
2. Occasionally this diarrhœa is uncontrollable and the cause of a fatal outcome.
3. It may appear out of a clear sky during an uneventful convalescence, either early or late in this period.

4. The exact causation of the severe diarrhoea is very difficult to determine and each case should be studied individually. The milder transient diarrhoeas are probably dyspeptic or irritative in origin.

5. Localized pericolic suppurative peritonitis, ileocolitis and proctitis, perhaps as a terminal infection in weakened patients, or in patients with renal insufficiency, must be considered in looking for an explanation, while it is just possible that too large a stoma may favor the development of this startling complication.

6. From a therapeutic standpoint, the mild cases seem to recover on simple diet and the usual astringent therapy; on the other hand, the severe cases have baffled all therapy, though if we may reason from analogy, one would expect to control some few of these if due to pericolic inflammation by a drainage operation. Those in which the complication seems to be of the type of a terminal infection superimposed on a cachexia or renal insufficiency will probably continue to be rebellious to therapy.

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- <sup>12</sup> Courtesy of Doctor McMillan.



## DOUBLE KIDNEY

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*Clinical Aspects.*—There is no essential difference between the various pathological conditions which are found in double kidney and those of a single kidney.

In 80 clinical cases (Tables I to IV) which have been collected, the incidence of the different diseases for which operation was performed is about the same as one expects to find in a single kidney, namely.

Infections (uncomplicated pyonephrosis and pyelonephritis) .	24 of 62 cases
Hydronephrosis (uncomplicated) .....	16 of 74 cases
Calculus disease (renal and ureteral) .....	24 of 80 cases
Hydronephrosis due to ureteral stricture .....	3 of 62 cases
Tuberculosis .....	14 of 74 cases
Obstruction by anomalous vessels .....	2 of 80 cases
Neoplasms .....	3 of 80 cases

It is self-evident that there are no pathognomonic symptoms indicative of disease of one or both halves of a double kidney which would enable one to recognize the condition clinically before operation.

Of the total of 80 collected cases, including two of the writer's, a pre-operative diagnosis of double kidney was made in 32 (40 per cent.). Of these the diagnosis was made through the aid of pyelography and opaque catheters in 23, by the observation of two ureteral orifices on one or both sides of the bladder in 7 cases and finally by noting that clear and turbid urine was obtained alternately from the ureteral catheter in 2 cases.

In 58 cases (60 per cent.) the diagnosis was either made at operation or upon examining the specimen.

It is of great interest to note that of the 32 cases in which the correct pre-operative diagnosis was made, the majority were reported during the past ten years, that is, since pyelography is employed as a more or less routine procedure in the examination of a urological case. (Figs. 30, 31, 32 and 33.)

In addition to the history and symptoms pointing to some surgical affection of the kidney the specific diagnosis of the presence of such disease in a double kidney is dependent upon the following data:

1. Finding two ureteral orifices on one or both sides of the bladder (Fig. 19). Under such circumstances the diagnosis may present no difficulties unless the ureteral orifices are far apart or are very small or one does not functionate and thus escape detection. Braasch and Scholl,<sup>40</sup> in a recent

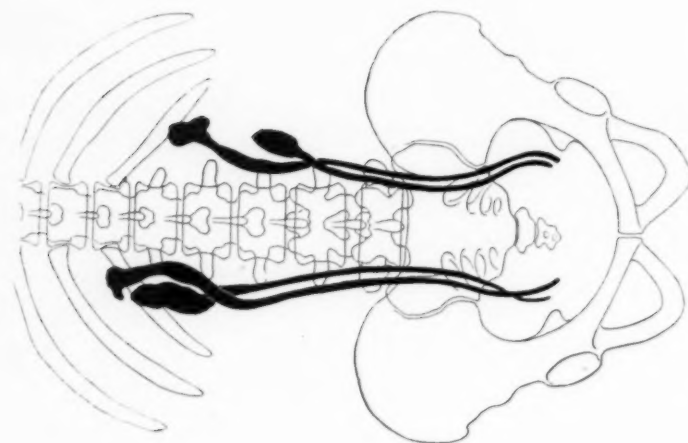


FIG. 32.—Tracing of pyelogram of complete bilateral reduplication of renal pelvis and ureters. (Necker Clinic-Legneu.)

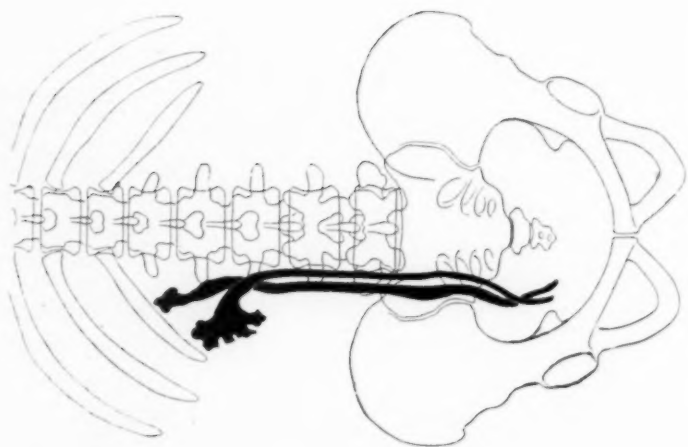


FIG. 31.—Tracing of pyelogram of complete unilateral reduplication of the renal pelvis and ureters. (Necker Clinic-Legneu.)

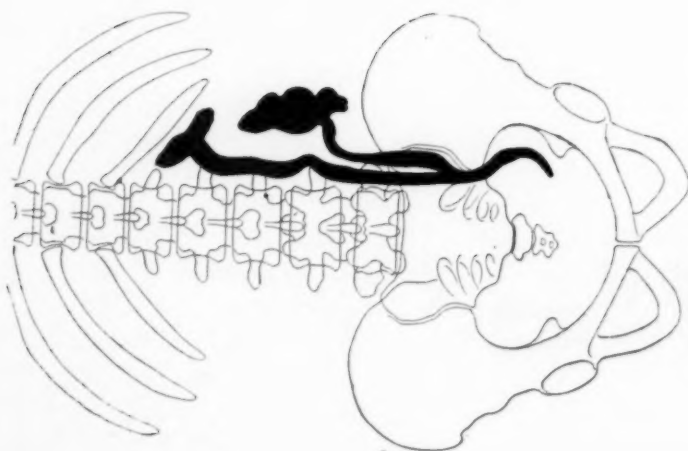


FIG. 30.—Tracing of pyelogram of unilateral incomplete reduplication of the renal pelvis and ureters. (Necker Clinic-Legneu.)

## DOUBLE KIDNEY

article, speak of the difficulty of finding two ureteral orifices if retraction is present, as is so often the case in tuberculosis.

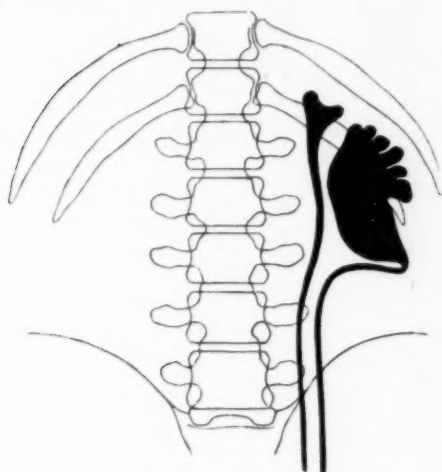


FIG. 33.—Double kidney. Tracing of pyelogram showing pyonephrosis of lower half. (Schönfeld and Friedl.)

Attention has been called under the head of morphology to: (a) the fact that a communication may exist between the ureters (Fig. 29), and (b) that the two renal pelvises may communicate. This is of great importance both in relation to diagnosis and treatment.

*Treatment.*—The presence of any of the conditions enumerated above as having been found in double kidneys calls for the application of the same principles of treatment as for similar affections of a single kidney with these exceptions. Every effort should be made to preserve one-half if the other half is so involved that heminephrectomy is indicated. Such an effort to perform an heminephrectomy depends: (a) upon the blood supply to the remaining half; (b) upon the possibility of separating the diseased half and its ureter from the normal half.

(a) *Blood Supply of Double Kidney.*—The ideal condition would be to find a separate set of vessels for each half, but unfortunately this is by no means the rule.

There are three types of blood supply, namely:

2. The presence of an ectopic orifice or other form of ending of one or both ureters of a double kidney. (Figs. 18 to 28.)

3. Obtaining on ureteral catheterization alternately clear and turbid urine from one kidney. This method of diagnosis has been superseded by the more exact ones to be enumerated.

4. If only one ureteral orifice is present on each side of the bladder the diagnosis can only be made if ureteropyelography is done as a part of a thorough urologic examination.

Disease of the upper half is not more frequent than is disease of the lower. (See tables.)

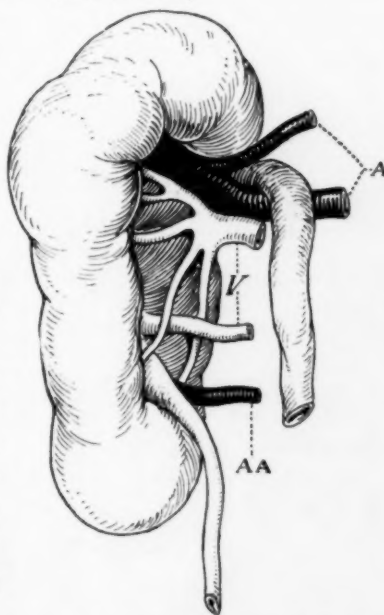


FIG. 34.—Double kidney removed on account of pyonephrosis of upper half. A single artery and vein for each half. (A and AA.) Two veins from lower half emptied into main renal vein for upper half. V. Main renal veins for upper and lower halves respectively. (Bruci.)

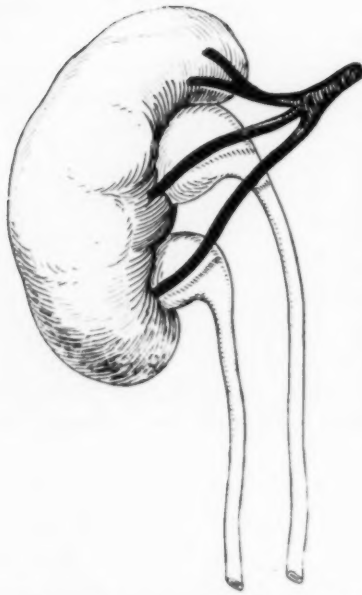


FIG. 35.—One artery for both halves of double kidney. (Duron.)

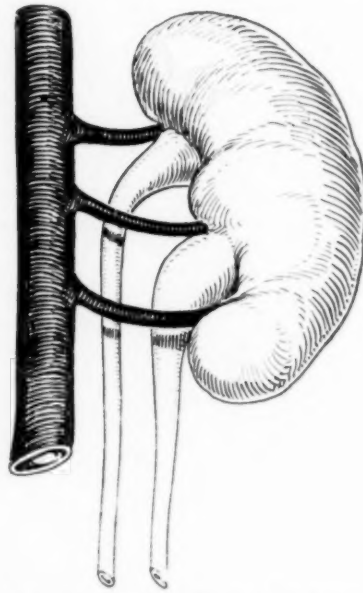


FIG. 36.—Three arteries for both halves of double kidney. (Duron.)

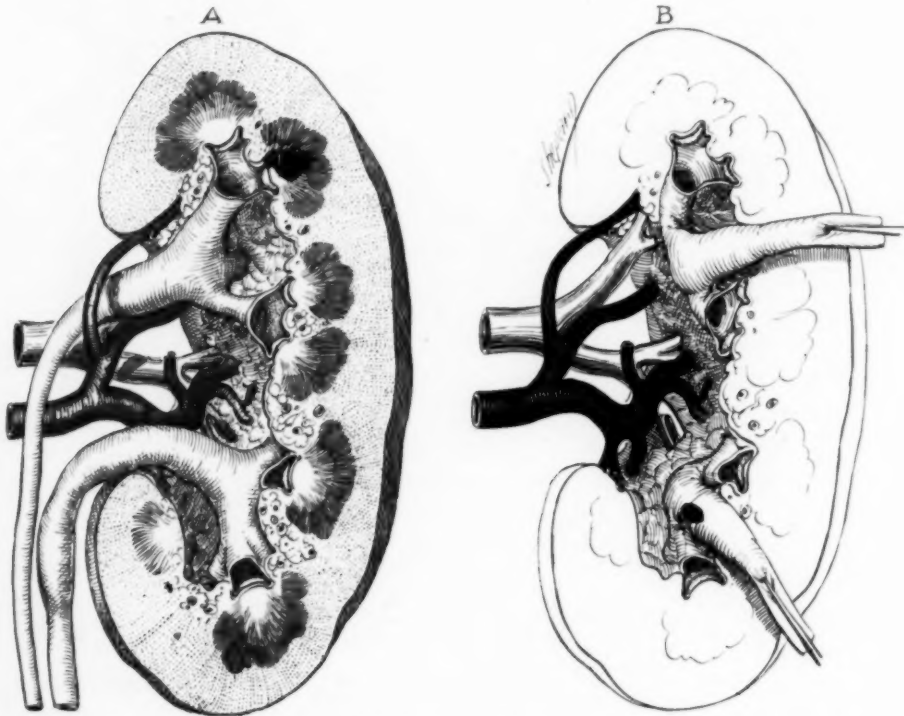


FIG. 37.—Double kidney specimen (own) showing a single artery and vein for both halves. A. With ureters *in situ*. B. With ureters retracted.

## DOUBLE KIDNEY

1. A single artery and accompanying vein for both halves. (Figs. 14, 35 and 37.)

2. Artery and vein for each half (Figs. 34, 37 and 39), one of these arteries may be an accessory vessel. (Fig. 39.)

3. Multiple arteries (3) for both halves. (Fig. 36.)

In 26 cases in which the number of vessels is mentioned, in five specimens which were personally examined through the courtesy of Professor G. Marion,



FIG. 38.—Double kidney (Marion). Note separate arteries (AS and VS) for upper and lower halves. US and UL, upper and lower ureters. Separate veins for each half (VS and VL).

of Paris, in one kidney seen at autopsy (Fig. 37) and in three cases observed at operation, a total of 35 cases, the following was found:

1. One artery for both halves—15 (43 per cent).
2. One artery for each half—15 (43 per cent.).
3. Three arteries for both halves—5 (14 per cent.).



This means that before one decides to perform an heminephrectomy the pedicle should be exposed to determine if there is sufficient blood supply for the remaining half. This is very difficult if there are many adhesions, and no doubt many complete nephrectomies will be done in the future as in the

past, unless a clear exposure of the blood supply is feasible.

(b) The next question concerns itself with the separation of the two halves. If an external indication in the shape of a groove or furrow is present (Figs. 3 and 5) the task is far simpler than where there are no external signs of demarcation (Figs. 1 and 2). The corresponding vessels having been first clamped or ligated, one incises through the zone of demarcation. The more complete the separation of the two halves the easier will be the removal of the diseased half (Fig. 40) and the less sutures will be required to cover the cut surface of the remaining half. There are certain conditions which

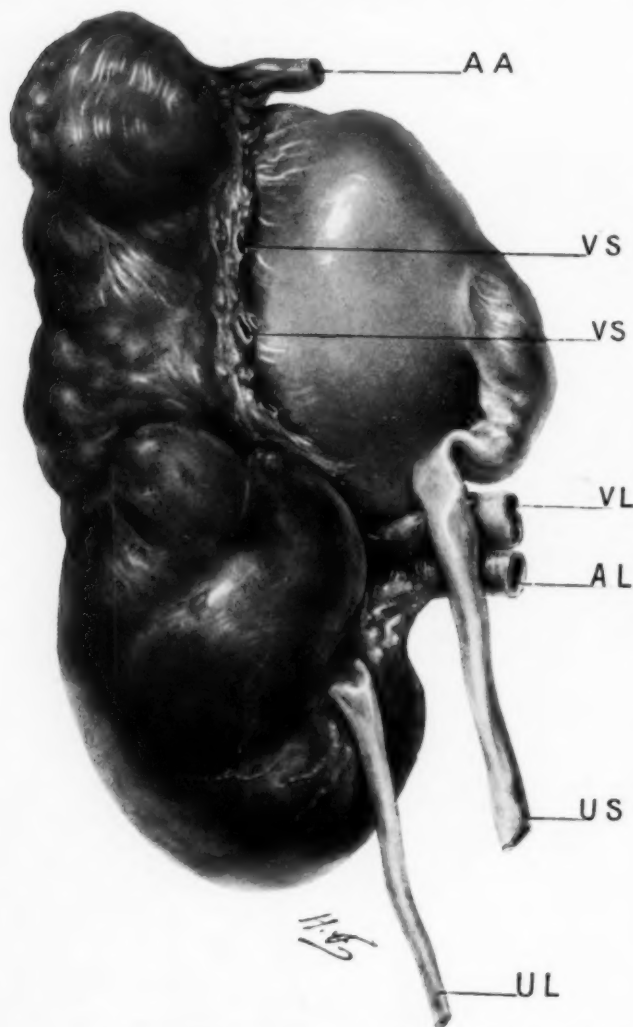


FIG. 39.—Hydronephrosis of upper half of double kidney (Krecke). AA, Accessory artery supplying upper half. VS, Two veins of upper half. VL, and AL, Vein and artery of lower half. US, and UL, Ureters of upper and lower halves.

serve as indication for a primary complete nephrectomy: (a) Infection, especially hæmatogenous (Fig. 1) involving both halves; (b) tuberculosis or neoplasms (malignant) unless there is complete separation of the two halves; (c) if the two pelves communicate or lie so close together that separation is impossible; (d) if the ureters lie in one sheath and cannot be separated; (e) advanced disease of both halves.

## DOUBLE KIDNEY

In the 80 collected cases (Tables I to IV) there have not been included those in which operations were performed for an ectopic ureteral ending because but few of these have been other than transplantation of the accessory or ectopic ureter.

A study of the four tables reveals some interesting facts. Both halves were described as being diseased in 21 cases of Table I. To this number must be added six in Table IV, in which a secondary removal of the remaining half was necessary. This makes a total of 27 out of 56 cases which did not permit of an heminephrectomy.

The remaining half was reported as normal in 12 of the 50 cases (Table I) in which complete primary nephrectomy had been performed, so that nearly 25 per cent. of the cases in Table I ought to have had only an heminephrectomy if the diagnosis of double kidney had been made before operation. In two of the cases such a diagnosis had been made, but for

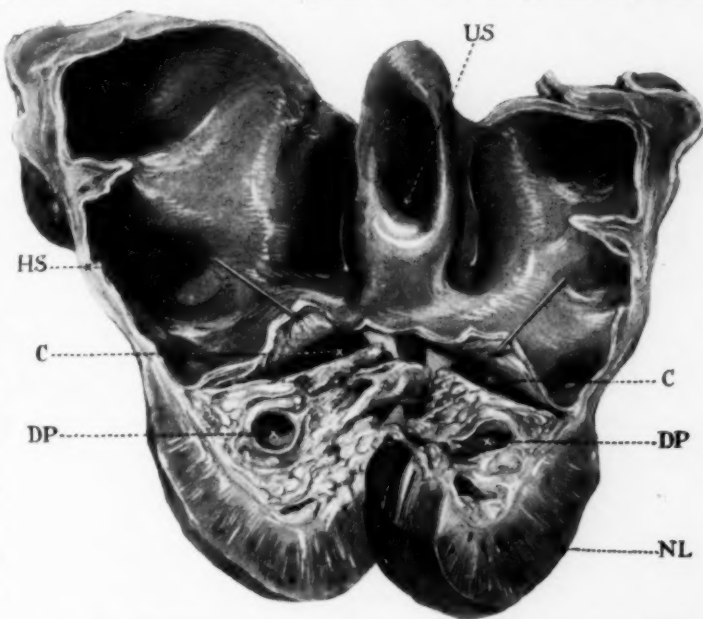


FIG. 40.—Specimen after complete nephrectomy of double kidney showing line of cleavage (C) between upper hydronephrotic and normal lower half. US. Upper ureter. HS. Sac of upper half. DP. Pelvis of lower half. NL. Parenchyma of lower half.

some reason no effort was apparently made to save the normal half. In one case (Kusnetzky<sup>41</sup>) the condition of the other half is not given.

In five cases of Table I, heminephrectomy was impossible because of technical difficulties. These are the cases of Tschudy<sup>42</sup> (No. 17)—vessels buried in adhesions, Hepburn<sup>43</sup> (No. 22)—lower normal half enveloped by the pyonephrotic upper half, my own case<sup>44</sup> (No. 32) in which the parenchyma showed no external signs of demarcation; fourth, the case of Braasch and Scholl<sup>45</sup> (No. 38)—the normal upper half emptied into the pelvis of the tuberculous lower half, and finally the case of Schoonover<sup>46</sup> (No. 45) in which the two ureters were enclosed in one sheath and could not be separated.

The accuracy of modern urological diagnostic methods is shown by the fact that it was possible to remove the diseased half in 12 cases (Table II).

TABLE I.  
*Operated Cases of Double Kidney.*  
 Cases in Which Complete Nephrectomy was Done, That is, Both Halves Removed at First Operation.

No.	Operator and reference	Age and sex	Pre-operative conditions	Diagnosis before operation	Conditions found at operation	End result
1	Floderus, Nord. med. Arkiv. No. 9, 1899	Female, 3½ years	Tumor and tenderness right upper quadrant <i>post scarlatina</i>	Infection of kidney	Pyonephrosis of upper half of double kidney, lower half normal. Complete nephrectomy that is of both halves.	Died 4 months after operation of sepsis.
2	Bruci, Ann. mal. g. u., June, 1911, 29, 961	Female, 22	Symptoms of pyelitis for four years. Single right ureteral orifice was swollen and red	Infection of kidney	Pyonephrosis upper half of double kidney. Lower half normal. Ureters joined juxta- vesically. Complete nephrectomy (both halves)	Not given.
3	Kusnetzky, Zett. Urol. 3, 927, 1909	Female, 35	Symptoms right kidney infection. Single right ureteral orifice. Cal- culus shadow in right pelvic ureter	Calculus obstruction of right infected kidney	Pyonephrosis of lower half of double kidney, with calculous obstruc- tion of ureter of this lower half. Ureters united in bladder wall. Complete nephrectomy	Two attacks anuria and left sided colics. X-ray showed shad- ows of two calculi in left ureter. These were expelled spon- taneously during attack of anuria.
4	Linck, D. Z. Chir. 75, 51, 1904	Female, 8	Enlarged kidney and pyuria (right)	Pyonephrosis of upper half of double kidney	Complete nephrectomy	Not given.
5	Rafin, Ann. mal. g. u., 27, 184, 1909	Female, 30	Tumor left kidney. Normal ureteral ori- fices	Not given	Hydronephrosis of lower half of double kidney. Upper half normal. Ureter only double at upper end. Complete nephrectomy	Not given.

# DOUBLE KIDNEY

6	Stark, Zeit. 1911 Urol., 5, 467,	Male, 16	Renal infection (left). Single gaping ureteral orifice	Infection of half double kidney made because obtained alternately clear and turbid urine per ureteral catheter	Pyonephrosis lower half double kidney. Upper half normal. Complete nephrectomy	Recovery.
7	Kroiss reported by Schoenfeld and Friedl Fort. a. d. Geb. Roent. 23, 169, 1915	Not given	Symptoms of bladder and kidney infection	Diagnosis of double kidney by pyelography	Pyonephrotic lower half due to kinked ureter. Complete nephrectomy. <i>One set of vessels</i> for both halves from which small vessels to lower half	Not given.
8	Dobrotworsky, Zeit. Urol. 7, 93, 1913	Not given	Marked bullous oedema of single ureteral orifice (right). No changes in single left ureteral orifice	Tuberculosis of kidney	After removal of kidney found only one half tuberculous. There was no demarcation between the two halves	Not given.
9	Adler reported by Ascher, Inaug. Diss. Berlin, 1908	Male, 29	Not given	Diagnosis of left hydro-nephrosis	Complete nephrectomy. Examination of specimen revealed large hydronephrotic lower half upon which cap-like, slightly hydronephrotic upper half rested	Not given.
10	Pawloff, Deut. Zeit. Chir. 121, 425, 1913	Not given	Tumor in right upper quadrant and persistent pain in lower abdomen increased by urination. Two normal ureteral orifices upon pre-operation examination. Small amount of pus from right ureter	Pyonephrosis (right)	Complete nephrectomy. Examination of specimen revealed pyonephrosis with calculus of lower half of double kidney. Ureter of this half obliterated close to anuria due to calculus in left kidney. This calculus removed by pyelotomy	Death 4 years later of uraemia. Found that left kidney was also double and there were two ureteral orifices on each side of bladder. There was a communication in bladder wall of the two ureters on each side.

TABLE I.—(Continued)  
*Operated Cases of Double Kidney.*  
 Cases in Which Complete Nephrectomy was Done, That is, Both Halves Removed at First Operation.

No.	Operator and reference	Age and sex	Pre-operative conditions	Diagnosis before operation	Conditions found at operation	End result
11	Pawloff, (Case 6) <i>Idem.</i>	Male, 36	Frequent and painful urination. Bullous edema of right ureteral orifice. Tubercle bacilli in urine	Right renal tuberculosis	Tuberculosis of upper half of double kidney. Lower half normal. Complete nephrectomy	Recovery.
12	Wossidlo, (Case 1) Zeit. Urol. 14, 197, 1920	Not given	Uretrovaginal fistula following operation for ovarian cancer. Single ureteral orifices on both sides. Poor right kidney function	Diagnosis of double kidney not made before operation	Pyonephrosis of both halves of double kidney. Complete nephrectomy	Recovery.
13	Wossidlo, (Case 2) <i>Idem.</i>	Female, age not given	Recurrent left colics, hæmaturia and pyuria. Enlarged tender left kidney. Two left ureteral orifices found lying with a diverticulum. Turbid urine from upper half—normal urine from lower half	Diagnosis of double kidney made before operation by pyelography and X-ray catheters	No signs of division externally. Separate blood-vessels to each half and an accessory vessel to upper pole. Complete nephrectomy. Upper half pyonephrotic, lower half normal. Dense septum separated	Not given.
14	Rubritius, Deut. Med. W. Feb. 12, 1920, 46, Vereins Beitrag, p. 19	Female, 29	Recurrent left kidney pain. Two ureteral orifices on left side. B. Coli obtained from lateral orifice	Diagnosis of infected hydronephrosis of upper half of double kidney made by pyelography	Pyonephrosis of upper half of a double kidney with rudimentary lower half. Complete nephrectomy	Not given.



# DOUBLE KIDNEY

15	Pallin, Nord. Med. Arkiv, 50, 1, 1917	Male, 12	Pyuria, pain (right) and increased frequency. Tender enlargement in right upper quadrant	Pre-operative diagnosis of infected right kidney	Complete nephrectomy of double kidney whose lower half was pyone- phrotic. Ureter from lower half greatly di- lated and tortuous, pro- bably a congenital sten- osis	Not given.
16	Troell, Hygiea, 1913	Female, 64	Pus from right and clear urine from left single ureteral orifices	Infection of right kidney	Found double kidney. First removed upper pyonephrotic half and then lower half because did not feel certain enough blood supply	Not given.
17	Tschudy, Korrb. Schiv. Aerzte, 13, 400, 1902		Symptoms of renal in- fection. Alternately clear urine and thick pus from left ureteral orifice	Infection of right kidney	Found double kidney. Could not resect pyone- phrotic upper half be- cause blood-vessels were buried in adhes- ions, so performed com- plete nephrectomy. Specimen showed sten- osis of ureter to upper half	Not given.
18	Papin, J. d'Urol. Feb. 1921, 11, 155	Female, 25	Pain over right kidney. Two right and one left ureteral orifices. Left kidney normal	No pre-operative diag- nosis given.	Complete nephrectomy of double kidney. Both halves hypoplastic	Not given.
19	Key, Z. Urol. 4, 409, 1909	Female, 18	Pain over right kidney and shadow over this kidney area	Calculus right kidney	Complete nephrectomy of a double kidney, upper half of which was tuberculous and lower half hydronephrotic	Not given.
20	Merrill and Lefebvre, Bull. Soc. Anat. 18, 387, 1921	Female, 35	Symptoms of renal tu- berculosis for several years	Tuberculosis of kidney	Complete nephrectomy, both halves tubercu- lous. Ureters united 11 cm. below kidney	Not given.

TABLE I.—(Continued)  
*Operated Cases of Double Kidney.*  
 Cases in Which Complete Nephrectomy was Done, That is, Both Halves Removed at First Operation.

No.	Operator and reference	Age and sex	Pre-operative conditions	Diagnosis before operation	Conditions found at operation	End result
21	Rumpel, Archiv. 81, 433, 1906	Male, 27	Recurrent left-sided abdominal pain	None given	Complete nephrectomy of dystopic double kidney, one-half of which was hydronephrotic	Not given.
22	T. N. Hepburn, Ann. Surg. 68, 294, 1918	Female, 45	Pyuria and enlarged right kidney. Two ureteral orifices on each side. Purulent urine only from upper right ureteral orifice	Diagnosis of bilateral double kidney and ureters made by pyelography	Complete nephrectomy of double kidney, upper half of which was pyonephrotic and so enveloped lower half that separation was inadvisable	Recovery.
23	Baetzner, p. 103 of Kidney Surgery, Julius Springer, Berlin, 1921	Female, 42	Recurrent symptoms of cystitis and right upper quadrant pain. Tumor in same location. Single right and left ureteral orifices	Hydronephrosis	Complete nephrectomy of double kidney. Upper half showed advanced tuberculosis and lower half hydronephrotic	Recovery.
24	Paul M. Pilcher, Ann. Surg., May, 1917, 65, 534	Male, 41	Recurrent hematuria, increased frequency and pain over right kidney. Purulent urine from single right ureteral orifice. Large shadow in right kidney	Calculus in infected kidney	Complete nephrectomy of double kidney, both halves showed infected hydronephrosis with calculus obstructing lower half	Recovery.
25	Heil, Zeit. Urol. Chir. 9, 82, 1922	Female, 7	Pyuria, increased frequency and tubercle bacilli in right kidney urine	Renal tuberculosis	Complete nephrectomy of double kidney showing tuberculosis. One ureter had been mistaken for vessel	Not given.

# DOUBLE KIDNEY

26	A. Mueller, Zeit. Urol. Chir. July 31, 1922, 9, 141	Female, 18	Increased frequency, pain, pyuria. Two left and one right ure- teral orifices. Pyelo- graphy unsuccessful	Diagnosis of double kid- ney with absence of function of upper half	Complete nephrectomy of double kidney, both halves hydronephrotic	Recovery.
27	A. R. Stevens, Jour. Amer. Med. Assn. Dec. 28, 1912, 2298	Female, 43	Pain over right kidney and hematuria. Two right ureteral orifices from one of which blood and decreased function	Diagnosis double kidney with hypernephroma of lower half made by pyelography	Complete nephrectomy of double kidney whose lower pole was seat of hypernephroma	Recovery.
28	Lange, Ann. Surg. 34, 581, 1901	Male, 56	Hematuria, pain over left kidney, chills, fever and recurrent anuria. Only one left ureteral orifice	Renal infection	Complete nephrectomy of septic double kidney	Recovery.
29	Cecil, Calif. St. J. Med. Jan., 1915, 13, 34	Female, 48	Symptoms renal infec- tion (left). Two left and one right ureteral orifices	Diagnosis of double kid- ney made by pyelo- graphy	Complete nephrectomy of double left kidney— lower half of which was hydronephrotic	Recovery.
30	Swan, Proc. Royal Soc. Med. 14, 33, 1921	Male, 35	Symptoms left renal in- fection. Urine and bladder negative on examination	Renal infection	Complete nephrectomy of double kidney, lower half of which revealed large hydronephrosis. Ureters united near bladder	Recovery.
31	Eisendrath, Surg. Clin. Chicago, Oct. 1917, 1, 1053	Female, 47	Symptoms left renal in- fection. Single ure- teral orifice on each side. From left cath- eter very turbid urine	Left-sided pyonephrosis	At first operation for drainage of infected hydronephrotic sac. Secondary complete nephrectomy of double kidney. Lower half was converted into large hydronephrotic sac. Ureter of upper normal half behind sac formed by lower half. Well marked separ- ation of halves	Died.

TABLE I.—(Continued)  
*Operated Cases of Double Kidney.*  
 Cases in Which Complete Nephrectomy was Done, That is, Both Halves Removed at First Operation.

No.	Operator and reference	Age and sex	Pre-operative conditions	Diagnosis before operation	Conditions found at operation	End result
32	Eisendrath, <i>Idem.</i>	Female, 25	Symptoms left renal infection. Single ureteral (left) orifice	Left renal infection	Complete nephrectomy of double kidney. Lower half seat of many abscesses (acute pyelonephritis). No separation of parenchyma	Recovery.
33	Braasch and Scholl, S. G. & O., Oct. 1922, 35, 401	Female, 9 months	Abdominal pain, fever and enlarged kidney	No pre-operative diagnosis	Complete nephrectomy of double kidney, both halves of which revealed infected hydronephrosis	Recovery.
34	Braasch & Scholl, S. G. & O., Oct. 1922, 35, 401	Female, 52	Dull pain in back, pyuria (left), increased frequency and small shadow in left kidney area. Ureter impermeable 20 cm. up	Diagnosis of left pyonephrosis	Complete nephrectomy of double kidney, both halves hydronephrotic. At junction of ureters (3 cm. down) calculus obstruction	Recovery.
35	Braasch & Scholl, <i>Idem.</i>	Female, 34	Symptoms of right renal infection. Single ureteral orifices on each side	Diagnosis of double kidney (right) with hydronephrosis of upper half, made by pyelography	Complete nephrectomy of double kidney whose upper ureter and pelvis were markedly dilated	Recovery.
36	Braasch & Scholl, <i>Idem.</i>	Female, 32	Pain in left upper quadrant. Much retention in pelvis of left kidney as shown in pyelogram	Left hydronephrosis	Complete nephrectomy of double kidney with much dilated lower pelvis	Recovery.

# DOUBLE KIDNEY

37	Braasch & Scholl, <i>Idem.</i>	Male, 37	Symptoms and usual findings of left renal tuberculosis.	Occluded left renal tuberculosis	Complete nephrectomy of both halves of tuberculous kidney. Well marked groove and band of parenchyma between two halves	Recovery.
38	Braasch & Scholl, <i>Idem.</i>	Female, 25	Pain left kidney, hematuria and pyuria. Several small shadows in left kidney area. Cystoscopy negative but blood from right ureter	Diagnosis of left double kidney made by pyelography	Complete nephrectomy of double kidney, lower half of which was tuberculous. Upper half normal but emptied into lower half. Deep external groove and band of parenchyma between halves	Recovery.
39	Braasch & Scholl, <i>Idem.</i>	Male, 33	Symptoms and usual findings of left renal tuberculosis	Renal tuberculosis	Complete nephrectomy of double kidney, both halves of which showed advanced tuberculosis	Recovery.
40	Braasch & Scholl, <i>Idem.</i>	Female, 50	Symptoms and usual findings of right renal tuberculosis with two right ureteral orifices, left upper of which was eroded and turbid urine escaped. Stricture of ureter of other half	Diagnosis of double kidney made by pyelography	Complete nephrectomy of double kidney. Lower half tuberculous, and upper half showed microscopically few tubercles in cortex	Recovery.
41	Braasch & Scholl, <i>Idem.</i>	Male, 35	Symptoms and usual findings of left renal tuberculosis	Left renal tuberculosis	Complete nephrectomy of double kidney, advanced tuberculosis of lower half and incipient of upper half (microscopic)	Recovery.



TABLE I.—(Continued)  
 Operated Cases of Double Kidney.  
 Cases in Which Complete Nephrectomy was Done, That is, Both Halves Removed at First Operation.

No.	Operator and reference	Age and sex	Pre-operative conditions	Diagnosis before operation	Conditions found at operation	End result
42	Braasch & Scholl, <i>Idem.</i>	Male, 26	Symptoms renal infection of left kidney. Pyelography showed inflammatory changes in left pelvis	Chronic pyelonephritis with atrophy	Complete nephrectomy of double kidney. Upper half completely destroyed while parenchyma of lower half replaced by fat	Recovery.
43	Braasch & Scholl, <i>Idem.</i>	Female, 47	Symptoms mild left renal infection. Pyelogram showed small left pelvis	Atrophic pyelonephritis	Complete nephrectomy of double kidney whose lower half almost completely destroyed by fibrosis	Recovery.
44	Braasch & Scholl, <i>Idem.</i>	Female, 30	Symptoms left renal infection. Pyelogram showed small left pelvis	Atrophic pyelonephritis	Complete nephrectomy of double kidney. Many cortical abscesses in lower portion. Pelvis dilated and almost replaced by fat	Recovery.
45	F. S. Schoonover, J. Urol. Aug., 1922, 8, 155	Male, 28	Symptoms of right renal infection. Two right ureteral orifices, lateral dilated and turbid urine escaping from it	Diagnosis of double kidney (right) with infected hydronephrosis and atrophy of the lower segment made before operation	Complete nephroureterectomy necessary because two ureters were intimately related and enclosed in a common sheath down to a point 10 cm. above the bladder. Section of the kidney after operation showed that the two pelvis were so closely adjacent that heminephrectomy would have been very difficult	Recovery.

# DOUBLE KIDNEY

	Burger, S. G. & O., Feb. 1919	Male, 38	Symptoms renal infection and several shadows in renal area (left). Two left ureteral orifices. B. Coli obtained from one and B. Coli and many pus cells from the other left ureter	Diagnosis of infection of both halves of double kidney made from results of cystoscopy and ureteral catheterization	Complete removal of left half of horseshoe kidney which had two pelvis and two ureters. The upper part was seat of advanced renal infection and contained two calculi. No external demarcation	Recovery.
46						
47	Wulff, D. M. W. 32, 1761, 1906	Not given	Alternation of pus and clear urine from left kidney	Diagnosis of double kidney made from alternation of pus and clear urine	Lower half (left) pyonephrotic. Complete nephrectomy	Not given.
48	Marion, Bull. Soc. Chir. 34, 905, 1908	Female, 41	Symptoms of right renal infection	Pyonephrosis	Hydronephrosis lower half of double kidney. Complete nephrectomy	Recovery.
49	Dumitreanu, (operator Dollinger). Deut. M. W. July 23, 1908, 34, 1333	Not given	Symptoms of right renal infection	Renal infection	After complete nephrectomy found that had removed double kidney. Upper half normal. Lower half showed infected hydronephrosis. Ureters very close	Recovery.
50	John E. Summers, Ann. Surg. Jan. 1901, 33, 39	Female, 2 1/2 years	Tubercle bacilli in urine. Enlarged left kidney. Incontinence	Renal tuberculosis	Complete nephrectomy of double kidney. One ureter very thick, other normal	Recovery.

TABLE II.  
Cases in Which Only Primary Heminephrectomy was Done.

No.	Operator and reference	Age and sex	Pre-operative condition	Diagnosis before operation	Conditions found at operation	End result
1	Heyman, Med. Woch. Deut. Feb. 15, 1912, 38. Ver-eins Beitrage, 344	Female, 21	Symptoms and findings of left renal tuberculosis. Two left ureteral orifices, of which mesial ulcerated and lateral normal	Tuberculosis of left kidney	Removal of upper tuberculous half only (heminephrectomy). Lower half normal	Not given.
2	Steiner, Kl. Woch. 38, 411, 1901	Female, age not given	Haematuria, pyuria. Enlarged and painful right kidney	Renal infection	Upper half resected. Lower half sutured into wound	Recovery.
3	Rumpel, Zeit. Urol. Chir. 3, 33, 1914. (First case of heminephrectomy)	Male, 39	Left-sided colics, tender left kidney, haematuria, pyuria. Calculous shadows opposite fourth lumbar vertebra. Two ureteral orifices on each side. Left lateral orifice redder, swollen and no indigo carmine excreted	Diagnosis of calculous hydronephrosis of lower half of double kidney made by pyelography	Lower half of double kidney much dilated containing calculus. Resected lower half. Upper half normal	Post-operative urinary fistula.
4	Rumpel, Idem.	Male, 35	Symptoms of post-gonorrheal renal infection. Two ureteral orifices on each side. From left mesial, clear and from left lateral (which gaped) turbid urine escaped	Diagnosis of hydronephrosis of lower half of double kidney made by pyelography	Resection of lower hydronephrotic half of double kidney felt to be safe because could identify blood-vessel to upper half	Recovery.

# DOUBLE KIDNEY

5	Pawloff (Case 3), Deut. Zeit. Chir. 121, 425, 1913	Female, 28	Painful and enlarged right kidney. Single normal ureteral orifice both sides. Negative catheterization both sides	Pre-operative diagnosis not given	Resected lower hydro- nephrotic half of double kidney. Ureter of this half found obli- terated	Recovery.
6	Young and Davis, Jour. Urol. Feb. 1917, 1, 17	Male, 57	Recurrent pain and in- creased frequency. Shadow branching cal- culus in upper pole left kidney. Single ureteral orifices on each side	Diagnosis of double left kidney made before operation by pyelo- graphy. Upper large pelvis seen to be filled by calculus	Heminephrectomy of hy- dronephrotic upper half filled by calculus. Slight but distinct furrow be- tween halves	Recovery.
7	Legueu, Necker Clinics, Second series, p. 243. A. Maloine et Fils, Paris, 1922	Female, 17	Symptoms of cystitis. Two left and one right ureteral orifices. Tu- bercle bacilli urine from one of left and from the right ureter	Diagnosis of double kid- ney (left) of which one half tuberculous. Con- firmed by pyelography	Heminephrectomy of upper half of left tuber- culous kidney, later ne- phrectomy of right tu- berculous kidney. Double kidney had two sets of vessels	Recovery.
8	Hryntsckak, Zeit. Urol. Chir. 9, 87, 1922	Male, 27	Recurrent left colics, pyuria and cystitis	Diagnosis double kidney made by pyelography	Heminephrectomy of pyonephrotic lower half double kidney	Recovery.
9	F. C. Herrick, Surg. Gyn. & Obst. 30, 560, 1916	Female, 18	Increased frequency and pain over right kidney. Two right ureteral orifices, lower of which showed bullous oedema	Diagnosis double kidney by pyelography	Heminephrectomy of lower hydronephrotic half of double kidney	Recovery.
10	A. Mueller, Zeit. Urol. Chir. July 31, 1922, 9, 141	Female, 29	Pain over right kidney increased frequency and burning. Two left and one right ure- teral orifices. Right lateral cranial no indigo carmine and only two c.c. purulent urine in one hour	Diagnosis of infected hy- dronephrosis of lower half of double kidney made by pyelography	Resected lower atro- phied, inflamed half of double kidney. Main vessels to upper half. Distinct groove be- tween halves	Recovery.

# DOUBLE KIDNEY

TABLE II.—(Continued)  
Cases in Which Only Primary Heminephrectomy was Done.

No.	Operator and reference	Age and sex	Pre-operative condition	Diagnosis before operation	Conditions found at operation	End result
11	Braasch & Scholl, (Mayo Clinic), S. G. & O. Oct. 1922, 35, 401	Female, 27	Severe recurrent right kidney pain. Branch- ing shadow in kidney area. Single ureteral orifices on each side	Diagnosis of double kid- ney with shadow in lower pelvis made by pyelogram	Heminephrectomy of lower half which was infected and obstructed by calculus. Well- marked groove. Each half had own vessels	Recovery.
12	Braasch & Scholl, <i>Idem.</i>	Female, 32	General discomfort right side abdomen for six years. Palpable right kidney. Two right ureteral orifices	Diagnosis double kidney with stricture of one ureter of upper half made by pyelography	Stricture just above bladder and much di- lated ureter leading to upper half. Latter and the ureter to within 2 cm. of bladder remov- ed. Lower pelvis and ureter normal	Still pain on same side one year later.



TABLE III.  
Cases in Which Nephrotomy, Pyelotomy, etc., Were the Only Operations.

No.	Operator and reference	Age and sex	Pre-operative condition	Diagnosis before operation	Conditions found at operation	End result
1	Klose, D. Z. Chir. 72, 613, 1904	Female, 59	Enlarged, tender and mobile kidney. Two ureteral orifices (right) both functioned	Movable double kidney diagnosed by X-ray catheters	Found double kidney abnormally mobile and did nephropexy	Recovery.
2	Lessing, Berl. Kl. W. Aug. 28, 1905, 42, 1126	Not given	Symptoms and shadow of renal calculus	Renal calculus	Double kidney with well-marked groove. Ureters united 7 cm. below kidney. Calculus in lower half re- moved by nephrotomy	Recovery.
3	Mirabeau, Zent. Gyn. 30, 706, 1906	Not given. Brief case presenta- tion	Two ureteral orifices on each side	Not given	Drained tuberculous half of double kidney	Not given.
4	Seelig, Z. Urol. 5, 900, 1911	Female, 44	Symptoms of pyelitis. Two ureteral orifices on each side. Ureteral catheterization re- vealed infection of right upper and left lower pelves	Diagnosis of bilateral double kidney with complete separation of the ureters made by pyelography	No operation. Only pelvic lavage	Much improved.
5	Illyes, Folia Urol. 8, 636, 1913	Female, 32	Shadow of calculus in pelvis of right kidney. Two ureteral orifices, from lower purulent, and from upper, clear urine obtained	Calculus in infected right kidney	Pyelotomy for calculus in infected lower half. Only one blood-vessel to both halves	Not given.

TABLE III.—(Continued)  
Cases in Which Nephrotomy, Pyelotomy, etc., Were the Only Operations.

No.	Operator and reference	Age and sex	Pre-operative condition	Diagnosis before operation	Conditions found at operation	End result
6	Lichtenstern, Wien. M. W. Sept. 9, 1911, 61, 2431	Male, 32	Left colics, pyuria and increased frequency. Single ureteral orifices on each side. Left gaping, injected and urine contained many pus cells. One large and several small shadows at level of upper lumbar vertebra	Calculus pyonephrosis (left)	Found double kidney of which upper half was large hydronephrotic sac. Moved one large and several small calculi from upper half. Ureter of upper half ran behind lower half. Separate vessels for each half	Not given.
7	Israel (Case 7), Folia Urol. 1, 617, 1908	Not given	Not given	Calculi of left kidney	Found calculi in upper half of left half of horseshoe kidney having double pelvis and ureters	Not given.
8	A. Brunner, Beitr. 122, 136, 1921	Not given	Symptoms of renal infection. Two left and one right ureteral orifices. Turbid urine from left lateral orifice	Infection of double kidney	Complete nephrectomy of double kidney, lower half of which revealed infected hydronephrosis with abscess between this lower and a normal upper half, each half had own vessels	Recovery.
9	Illves, Folia Urol. 8, 636, 1913	Female, 32	Shadow of calculus in right kidney pelvis. From lower of two right ureteral orifices purulent urine, while clear urine obtained from the other one	Calculus of kidney	Removal of calculus from pelvis of lower half of double kidney	Not given.

# DOUBLE KIDNEY

10	Frank, Kl. Chir. Supplement to Vol. 64, 193, 1909	Female, age not given	Tumor and pain in right upper quadrant. Two right ureteral orifices. Normal urine from one but not from other	Diagnosis of double kidney made from presence of two ureteral orifices	Both pelves of double kidney found much dilated. One of the two ureters kinked by accessory vessel, which was ligated. Puncture of hydronephrotic sac	Recovery.
11	Young, Monatsbericht f. Urol. 1903, 8, 591	Male, 54	Left-sided colic with passage calculus two years before. Clear urine left and purulent right. Shadow large calculus in right kidney	Calculus right kidney	Removal large calculus from right kidney	Died of anuria. Ureteral catheter on left side had entered branch of bifid ureter leading to normal half of double kidney, in upper half calculus found which had not been shown in X-ray.
12	Brewer, Surg., June, 1911, 53, 82	Male, 28	Right colics, haematuria, tender right kidney and shadow below kidney	Renal calculus	Found hydronephrosis upper half double kidney due to calculus obstruction of ureter. Ureterotomy	Recovery.

# DOUBLE KIDNEY

TABLE IV.  
Cases in Which Heminephrectomy or Other Operations were Followed by Secondary Removal of the Remaining Half.

No.	Operator and reference	Age and sex	Pre-operative condition	Diagnosis before operation	Conditions found at operation	End result
1	Pizzetti, Policlinico, 28, (sez. chir.) 160, 1921	Male, 37	Symptoms and findings those of renal calculus	Renal calculus	Nephrotomy followed by recurrence and fis- tula. Complete neph- rectomy of double kid- ney.	Not given.
2	Braasch & Scholl, S. G. & O. Oct. 1922, 35, 401	Female, 45	Symptoms renal infec- tion and passage small calculus. Two ure- teral orifices on each side. Upper left di- lated and turbid urine escaped. Lower left normal. Shadow left kidney area	Diagnosis by pyelo- graphy of bilateral complete reduplica- tion of two left pelvis. Shadow in left dilated pelvis	Heminephrectomy of lower half dilated by calculus and small papilloma. Definite line of demarcation and two sets blood- vessels. Secondary re- moval of remaining half seven months later because of per- sistence of pain. Found only moderately thick- ened renal pelvis	Well 11 years after operation.
3	Braasch & Scholl, <i>Idem.</i>	Female, 41	Symptoms left renal in- fection and multiple shadows. Two ureter- al orifices on each side. Poor function of lower half of left kidney	Diagnosis of double kid- ney with multiple sha- dows in lower half con- firmed by pyelography	Heminephrectomy of hydronephrotic lower half containing several calculi. Obstruction of this half by anomalous vessel. Four weeks later compelled to re- move upper half be- cause of persistent in- fection of this half	Well three years after operation.

4	Braasch & Scholl, <i>Idem.</i>	Male, 46	Recurrent pyuria, hamaturia and pain over right kidney. Single ureteral orifices both sides. Small amount pus from right kidney. Multiple shadows over kidney area	Diagnosis of double kidney with multiple shadows in dilated lower pelvis, made by pyelography	At first operation small papillary cyst-adenoma enucleated from cortex and two small calculi removed from lower pelvis. Secondary complete nephrectomy six months later because of infection both halves	Recovery.
5	Braasch & Scholl, <i>Idem.</i>	Male, 45	Recurrent left kidney colic, with pus and blood in urine. Shadow opposite third lumbar vertebra	Left hydronephrosis with calculi	At first operation found both pelves of double kidney moderately dilated. Both ureters obstructed by calculus. Two years later obliged to do complete nephrectomy	Recovery.
6	Braasch & Scholl, <i>Idem.</i>	Female, 30	Increased frequency and pain over left kidney. Left (single) ureteral orifice slightly eroded. Ureteral catheterization negative on both sides	Diagnosis of double kidney made by pyelography	First resected lower atrophic portion of double kidney. This showed microscopically typical tubercles. Later removed upper half	Recovery.



Unfortunately the end results of the cases included in Table III are not given, inasmuch as in Cases 2, 6, 7, 9, 11 and 12 the operated half was the seat of calculi and in Case 3 (Mirabeau<sup>47</sup>) a tuberculous half was drained. No doubt a number of these were operated later.

The fact that so many renal and ureteral anomalies are being diagnosed before operation leads one to hope that a great many more heminephrectomies will be reported in the future.

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## A METHOD FOR DETERMINING THE QUESTION OF DRAINAGE IN INTRA-ABDOMINAL INFECTION

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THE question of drainage in cases of acute intra-abdominal infection is of paramount importance. In practical surgery one is confronted with the much larger number of cases in which the characteristics of the local findings make the institution of drainage imperative; these include the various forms of perforative lesions associated with marked peritoneal contamination, frank abscesses and oozing surfaces. Aside from these, there remains a group of borderline cases in which the question of drainage always arises and for which the old dictum "when in doubt, drain" still holds good.

In this communication a simple rapid method is described to aid in the decision of primary closure or drainage in these borderline cases. The method consists in making smears directly from the surfaces of the involved viscus and from any peritoneal exudate which may be present at the time of operation. Utilizing a rapid stain, the presence, or absence, of organisms is determined microscopically. (In this study the culture method was utilized merely for control purposes.) Similar to the Carrel technic for the determination of the degree of infection in wounds, the method attempts to ascertain approximately the degree of infection of the operative field by the number of organisms found per microscopic field. With the observation of a sufficiently large number of cases the determination of the greatest number of organisms per field compatible with the safe primary closure of the peritoneal cavity becomes possible.

Cases of appendicitis were chosen for study because they constitute the most common form of intraperitoneal infection and present the problem of drainage most often. The total number of cases studied is 46. At Mount Sinai Hospital cases of appendicitis are classified as follows:

1. Acute catarrhal forms.
2. Chronic appendicitis; including chronic catarrhal forms, chronic obliterative forms, and those with peri-appendicular adhesions.
3. Acute diffuse inflammatory and suppurative forms; including so-called empyemata; with and without peritoneal exudate.
4. Perforative and gangrenous forms with and without peritonitis.
5. Thrombotic forms.

The question of drainage never occurs in the cases of groups one and two, and it is always possible to close the wound primarily. Cases in these groups

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have served for control purposes. Cases falling in groups four and five practically always need to be drained; these, too, have functionated as control observations.

The question of drainage comes up repeatedly in the cases composing group three. Many of these cases need to be drained; many of these cases frankly need not be drained. Between these latter two subgroups is a third subgroup containing the cases which concern us mostly in this report.

There were 11 cases of these borderline kind in the total number studied. The facts regarding the gross pathological appearance of the appendix and operative field, as compared with the visible bacteriological content of the smears made at operation, are as follows:

Gross Pathology	Smear
1. Acute suppurative appendicitis; mucosa deeply inflamed and covered with a purulent exudate; muscularis thickened; serosa inflamed.	Negative for organisms. Few pus cells present.
2. Acute diffuse inflammation; no exudate.	Negative for bacteria and pus cells.
3. Tip of appendix acutely inflamed for a distance of one inch; serosa covered with fibrino-plastic exudate.	Negative for bacteria and pus cells.
4. Acute suppurative appendix; mucosa necrotic; covered with purulent exudate; small serous peritoneal exudate.	Negative for bacteria and pus cells.
5. Acute empyema in a diffusely inflamed organ; serosa covered with fibrino-plastic exudate.	Negative for bacteria and pus cells.
6. Acute diffuse inflammation; serosa covered with fibrino-plastic exudate; small amount of free turbid peritoneal exudate.	Negative for bacteria and pus cells.
7. Acute diffuse inflammation; mucosa covered with purulent exudate; small amount of sero-sanguineous fluid present in peritoneal cavity.	Negative for bacteria and pus cells.
8. Acute suppurative appendicitis; mucosa covered with purulent exudate; muscularis thickened; serosa inflamed; no free fluid.	Negative for bacteria and pus cells.
9. Acute suppurative appendicitis; mucosa necrotic and covered with purulent exudate; muscularis thickened; serosa inflamed; small amount of thin free fluid present.	Negative for bacteria and pus cells.
10. Acute diffuse inflammation; small sero-purulent exudate.	Negative for bacteria and pus cells.
11. Acute diffuse inflammation; small fibrino-purulent exudate.	Occasional Gram-negative bacillus and few pus cells.

*Summary.*—In the foregoing 11 cases the gross pathology indicated an acute diffuse inflammatory reaction which in some went on to various grades of suppuration. Peritoneal exudates were present in some. In all, except one,

no bacteria were demonstrable in the smear; in the exception only an occasional organism was seen. No one of these cases was drained at the close of the operation and the post-operative course was uncomplicated in any way in any one of them.

In ten cases falling in groups four and five which were studied the facts were as follows:

Gross Pathology	Smear
1. Gangrenous appendicitis with abscess; thick foul pus present.	Many Gram-negative bacilli and Gram-positive cocci in chains and clumps. Many pus cells.
2. Gangrenous appendicitis with perforation and purulent peritonitis.	Many Gram-negative bacilli and Gram-positive cocci. Many pus cells.
3. Gangrenous appendicitis with perforation and peritonitis.	Many Gram-negative bacilli and many pus cells.
4. Acute suppurative appendicitis with fibrino-purulent peritonitis.	Many Gram-negative bacilli and many pus cells.
5. Gangrenous appendicitis with perforation and diffuse peritonitis.	Many Gram-negative bacilli; fusiform and spiral forms (saprophytes); pus cells.
6. Gangrenous appendicitis with perforation and diffuse peritonitis.	Occasional Gram-negative bacillus; pus cells.
7. Acute suppurative appendicitis with diffuse peritonitis.	Many Gram-negative bacilli; pus cells.
8. Gangrenous appendicitis with perforation and diffuse peritonitis.	Many Gram-negative bacilli; pus cells.
9. Gangrenous appendicitis with perforation and diffuse peritonitis.	About 10 Gram-negative bacilli and Gram-positive cocci per field; pus cells.
10. Acute suppurative appendicitis with thick fibrino-purulent exudate.	About 2 Gram-negative bacilli per field; pus cells.

*Summary.*—In the foregoing ten cases in which drainage was frankly indicated, numerous bacteria were demonstrated in the smears in a uniform manner.

The cases originally classified in groups one and two at the beginning of this report are not described in detail, inasmuch as no one would ever think of draining such cases except under the most extraordinary of accidents. Bacteriologically these were all negative. These cases, too, were considered as control observations.

The method employed in making the smears is the following: Materials required: (1) thoroughly cleaned and dried platinum loop and two slides sterilized with the operating instruments; (2) alcohol lamp; (3) microscope with oil immersion lens; (4) cedar oil; (5) blotting paper; (6) Gram stain. The one employed has been in use in the laboratory for a great many years. It is prepared as follows:



## DRAINAGE IN INTRA-ABDOMINAL INFECTION

Anilin-water gentian violet: No. 1, gentian violet, 8.0; alcohol, 95 per cent., 100.0; mix well.

No. 2. Anilin oil, 28.0; HCl, 5.0; distilled water, 900.0; shake well and filter through wet paper. Mix No. 1 and No. 2. Filter again. (Solution will keep for months.)

Gram's iodine: Iodine, 1 part; potassium iodide, 2 parts; water, 20 parts. Dilute 30 c.c. of above in 420 c.c. of water or in similar ratio.

Aquæous fuchsin: Twelve per cent. aquæous solution of saturated alcoholic basic fuchsin.

*Procedure.*—The operation is conducted in the usual manner. When the appendix is isolated and before the appendicular artery is ligated or the mesenterium is incised, the platinum loop is placed in contact with the entire surface of the appendix (especially the tip and base). If free fluid is present, two smears are made, one from the surface of the appendix and one from the peritoneal exudate. If no fluid is present a drop of sterile water in the platinum loop facilitates the making of a smooth smear.

While the surgeon removes the appendix, the smear is dried and fixed over the alcohol flame and stained with Gram's stain in the usual sequence; the various stains need, however, remain in contact with the smear for 15 seconds each (rapid method); the smear is then dried with blotting paper and examined under the oil immersion lens.

From the time the smear is made to the time a rapid careful examination of numerous microscopic fields is made and the result reported, no more than five minutes need elapse.

*Precautions:* (1) Smears should be made thinly and evenly. (2) The presence of blood in the smear interferes with the recognition of organisms. (3) Gross contamination due to various manipulations makes the method inapplicable.

Cultivations were made in every case studied in order to control the observations made in the smears. It is readily to be understood that for practical surgical purposes, culture methods would be of no use whatsoever because of the time factor. The facts in the culture studies made, are the following. *Media:* One c.c. ascitic fluid; or 1 c.c. glucose bouillon. *Method:* At the time of making the smears a loopful of material from the surface of the appendix and from the peritoneal exudate, when the latter was present, was introduced into either of the two media. Within one to two hours, preferably immediately, blood agar mixtures were made from the latter cultures and plates were poured. In 24 to 48 hours the number of colonies per loopful of material could be estimated.

*Observations:* In the borderline group of cases: Cases 1, 2, 3, 5, 6, 7, 8, 9, culture sterile. Case 4, *B. coli*; colonies too numerous to count. Case 10, *staphylococcus aureus*; 50 colonies to the loopful. Case 11, *B. coli*; 5 colonies per loopful.

In the control cases (group 4 and 5) previously detailed, the cultivations uniformly showed the presence of *B. coli*; the number of colonies were

too numerous to count in all cases; there may have been other organisms present which, apparently, were overgrown by the colon group of organisms.

*Comment and Conclusions.*—A preliminary report is made concerning the utilization of the direct smear as a practical criterion in deciding the question of drainage after operations for intra-abdominal infections (appendicitis with and without peritonitis).

The bacteriologic content of smears carefully made at the time of operation may be used as a rough estimate of the degree of infection of the peritoneal cavity. Up to the present time the studies have shown that when such smears show an absence, or only the occasional presence (one organism in five or more high-power microscopic fields) or organisms, cases of intra-abdominal infection (cases of appendicitis in this series) can be closed without drainage after operation without untoward post-operative complication. The statement holds true in the absence of any other surgical contraindication to drainage such as hemorrhage or oozing surface.

Cultures made at the same time as the smears may show a growth even when no organisms are visible in the smear. In such cases the number of organisms present is undoubtedly small and the nature of our results indicates that in the cases studied the peritoneum and natural defense mechanism of the body are ample to take care of the contamination. This does not take into account the virulence of the individual organisms.

The studies will be continued and a further report will be made as to the upper limit of the number of organisms per microscopic field compatible with a safe primary closure.

## REDUPLICATION OF THE URETER

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IN a paper before the Medical Society of Virginia in 1916, subsequently published in *ANNALS OF SURGERY*, vol. lxxv, p. 355, the writer exhibited three instances of unilateral complete duplication of the ureter occurring in a series of one hundred cases subjected to cystoscopic investigation of certain urinary symptoms.

In the succeeding 400 cases of the same type four additional anomalies have appeared:

1. A ureter bifurcated in the upper fourth, with a common orifice at the vesical end and with separate independent pelves at the renal end.
2. Complete unilateral duplication, uncomplicated.
3. Complete unilateral duplication with multiple calculi in the normal pelvis on each side and dilatation of the rudimentary pelvis on the duplicated side.
4. Complete bilateral duplication, uncomplicated.

It is with particular reference to the last case that the present report is made, though the desirability of a general review of the field, with emphasis upon certain important clinical aspects of the anomaly, seems warranted at this time.

*Frequency of the Anomaly.*—The complicated embryologic processes which finally eventuate in the production of a normal anatomical entity become disarranged, in a greater or lesser degree, in a higher percentage of instances than is commonly recognized. It is our custom to think and act in terms of basic anatomy. The introduction of an aberrant element is therefore immediately confusing and sometimes disastrous, since failure to apprehend it may lead not only to diagnostic errors, but occasionally to surgical crises. A certain number of hepatic ducts have been cut due to ignorance or contempt of the fact that in a considerable percentage of instances this duct is not in its accustomed anatomical relationship with its fellows. Similarly two ureters may be explored and found negative while an undiscovered third may lead to the seat of a lesion for which the patient thereupon goes untreated.

It is interesting to note that such aberrant elements are more common in the genito-urinary system than in any other part of the body, and that of the various anomalies present here the duplicated ureter is perhaps the most frequent. The incidence, three per cent., in the writer's original report, has not been maintained in the succeeding series, but, without regard to the probability that he has himself overlooked some, the percentage in 500 cases is still 1.4.

The embryologic basis of the anomaly has been well worked out by Kelly and has been previously described by the writer. It need be only casually reiterated in this report which is essentially clinical in its application. The ureter originates as an offshoot from the Wolffian duct, the bud growing and dividing distalward until pelvis, calyces, and straight uriniferous tubules are produced and finally become united with the secreting portion of the kidney which is elaborated by an independent group of cells of different origin. Precocious division of this off-shoot may result in a Y-shaped canal, each limb leading to an independent pelvis, as exhibited in Case IV. This condition is fairly common. Irregular division at a higher level may produce anomalies of lesser note with individual large calyces, pelves of unusual shapes, etc.; these are being constantly observed. The explanation of complete duplication, however, with an independent pelvis at one end and an independent bladder orifice at the other, is not so easy. Of the various theories advanced the simplest appears to be the most likely, namely, that there is a double evagination from the Wolffian duct instead of one. The writer is not aware of any authentic report which would indicate the possibility of a true supernumerary kidney or a fusing together of two kidneys on one side. Complete unilateral duplication of this sort (Cases I, II, III, V, and VI) though not common, is not rare, and quite a large number of instances have been reported. Complete bilateral duplication, however (Case VII), is much more unusual and relatively few cases have appeared in the literature.

The rotation of the kidney in its ascent to the lumbar fossa produces usually a characteristic crossing of the duplicated ureters. Kelly describes one point of crossing and Braasch two. In one of our cases there was no crossing; in one instance there were three points of crossing, and in all others two; in no case was there a single point of crossing. If the two buds come off from the Wolffian duct simultaneously, or nearly simultaneously, the lower ends will be found close together in the bladder; if a longer interval prevails, they are further apart, and one of them may even come to lie in the urethra. In our cases the orifices were always closer together. One of the duplicated pelves is usually of rudimentary size.

The recent elaborate and impressive report by Braasch from the Mayo Clinic constitutes probably the most important clinical survey of this subject. In the presence of figures of such dimensions one hesitates to submit the few cases here recorded. The writer presents them with the sole idea that they perhaps exhibit certain features which may contribute something of interest if not value to the rapidly accumulating data.

*Summary of Cases.*—CASE I.—Miss M. G., white, female, unmarried, aged thirty. Right urinary tract negative. On left side two vesical orifices situated about one-quarter inch from each other. Pyelo-ureterogram with leaded catheters in position showed complete duplication on left side (Figs. 1 and 2), the median ureter crossing the lateral a short distance above the bladder and recrossing it a short distance below the pelvis, which was higher placed and much smaller than the other. This patient had a pyelitis which was limited to the rudimentary pelvis and which promptly cleared up under lavage.

# REDUPLICATION OF THE URETER



FIG. 1.—Upper Tract



FIG. 2.—Lower Tract

Case I.—Unilateral reduplication, with infection limited to rudimentary pelvis illustrated in Fig. 1. Cure following lavage.



FIG. 3.—Upper Tract

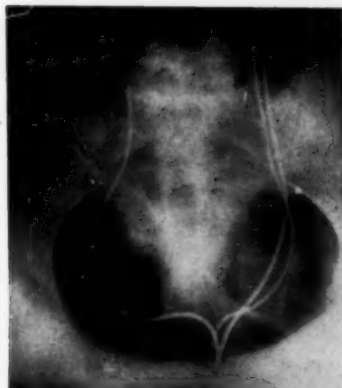


FIG. 4.—Lower Tract

Case V.—Unilateral reduplication without pathology. Course of duplicated ureters shown but satisfactory pyelogram could not be obtained.



FIG. 5.—Upper Tract

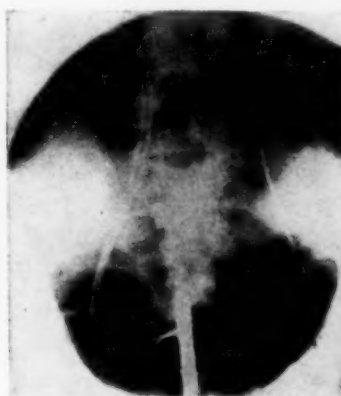


FIG. 6.—Lower Tract

Case III.—Unilateral reduplication with infection limited to one of duplicated pelvis. Cure following lavage.



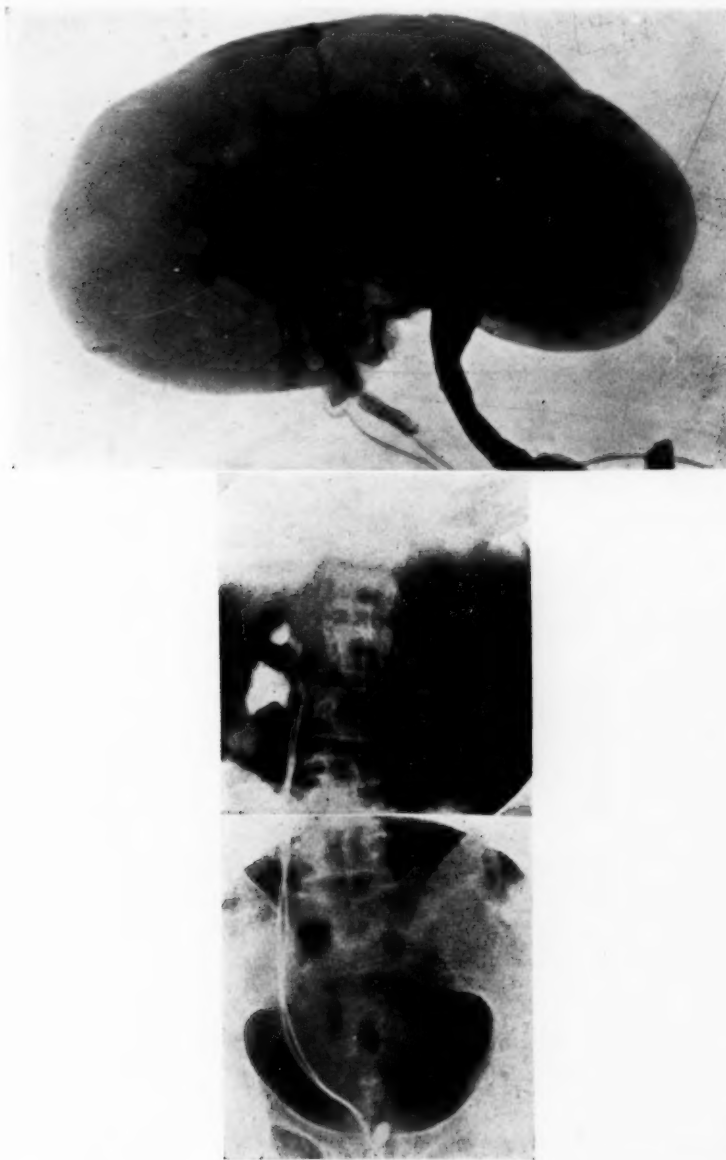
CASE II.—Mrs. M. C., white, female, widow, aged thirty-eight. Left urinary tract negative. On right side, close together, were two ureteral orifices, one of pin-point size. Pyelo-ureterogram with leaded catheters in position showed complete duplication on right side with double crossing of ureters, the median ureter leading to a pelvis higher situated than the others and both pelvic shadows being atypical (Figs. 8 and 9). Infection was present in both of the right pelves and the left side was normal; the rudimentary ureter was sharply contracted. For years this patient had been a semi-invalid with right-sided pain for which she had undergone a series of ineffective operations, including appendectomy, separation of adhesions, colectomy, hysterectomy and exploration. Following lavage of the right renal pelves, enlargement of the orifice of the rudimentary ureter, and dilatation of the ureter itself, she was free of pain for more than twelve months. Her trouble then began to recur and though subsequent dilatation of the right ureters always produced definite results the free intervals became shorter and shorter. Finally, when she had become nearly bed-ridden the writer performed a nephrectomy since which time, after some vicissitudes due to the condition of her frequently explored abdomen, she has practically entirely recovered her health. An injection of this kidney was made after its removal (Fig. 7); in spite of the small amount of solution used (3 to 5 c.c.) the bromide can be traced through the ramifications of the minute tubules; a lesson in the dangers of pelvic lavage when conducted with a syringe.

CASE III.—J. N. C., white, male, married, aged twenty-four. Left urinary tract negative. On right side two vesical orifices situated close together, one slightly anterior and medianward to the other—which is the usual relationship. Pyelo-ureterogram with leaded catheters in position showed complete duplication on this side (Figs. 5 and 6). The supernumerary pelvis appeared more normal in size and shape than the others in this series. The patient came in for vesical disturbance due to cystitis, secondary to a staphylococcic infection limited to the pelvis attached to the right lateral ureter. Under local treatment of the bladder, the usual internal medication and lavage of the infected pelvis with silver nitrate, he promptly recovered.

CASE IV.—Mrs. J. E. S., white, female, married, aged forty-eight. Nothing unusual seen in bladder. Bilateral pyelogram showed kink in right ureter which, with its pelvis, was otherwise normal; on left side there was a bifurcation of the ureter at the level of the top of the fourth lumbar vertebra and each limb of the ureter then ascended to a separate pelvis. The ureter from the upper pelvis appeared to be dilated. This patient came in for persistent left lumbar pain so severe as to make her a chronic invalid. An exploratory operation was done. The double pelves were demonstrated and the two stems of the ureter were found to coalesce about one and one-half inches below the kidney. The upper ureter was sharply constricted by an aberrant vessel which was divided. An incision was made into the ureter near the junction of its branches and further exploration was made with a No. 9 bulbous bougie. No constrictions being located the kidney was returned to its position. Subsequently this patient developed a recurrence of her pain and underwent a secondary operation elsewhere; at that time it was stated that the true capsule of the kidney was found to have been stripped off from the parenchyma and distended by an accumulation of bloody fluid so that the kidney lay in a sac composed of its own capsule, from which it was separated by about an ounce of this fluid. The operator stripped the capsule off completely and then restored the kidney to its normal position. Shortly after the operation the patient was reported free of pain. She has not been heard from since.

## REDUPLICATION OF THE URETER

CASE V.—Miss M. J. C., white, female, unmarried, aged twenty-two. Right urinary tract negative with exception of what appeared to be a stricture in the ureter, probably responsible for the right sided pain which brought her to the



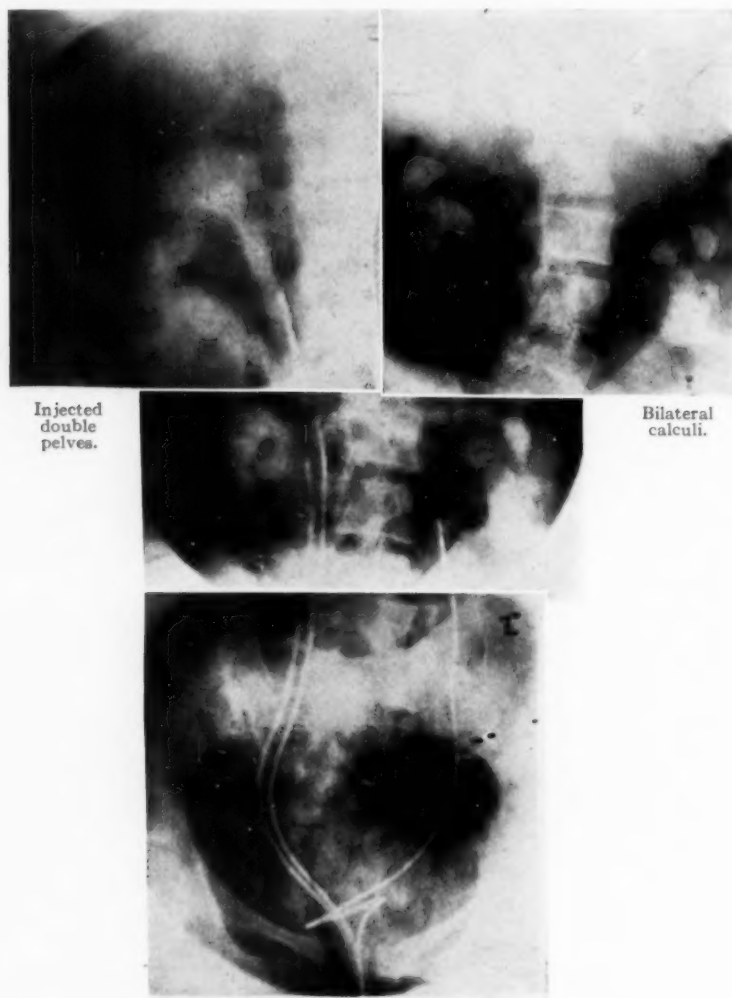
FIGS. 7, 8 and 9.—Unilateral reduplication. Small plates, together, show entire course of duplicated ureters, terminating in separate pelves. In this case persistent pain and infection ultimately required nephrectomy. After its removal kidney was injected and is shown in large plate above. Note diffusion of bromide through tubules. (Case II.)

hospital. On left side, in close approximation, were seen two ureteral orifices, one being exceedingly small. Pyelo-ureterogram (Figs. 3 and 4) with catheters in position, showed complete duplication on left side with the usual double crossing

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of ureters. The right pelvis was well filled. The intolerance of the patient to manipulation prevented satisfactory filling of the left pelvis. No infection was present on either side and the patient had no symptoms referable to duplicated pelvis. She has not returned for further observation.

CASE VI.—Mrs. T. J. W., white, female, married, aged thirty-five. It is interesting to note in this remarkable case that the patient came not for pain or



FIGS. 10, 11, 12 and 13.—Unilateral reduplication with bilateral calculi. Two plates below show courses of duplicated ureters. Above on reader's left is pyelogram of duplicated side, showing dilatation of rudimentary pelvis; on right is plate covering both sides of upper tract and showing collection of large calculi on each side. (Case VI.)

serious bladder disturbance but for indigestion, anorexia, and a tendency to miscarriages, of which she had had about seven. A routine analysis disclosed a large amount of pus and further inquiry brought out the fact that she at times had some frequency and straining, but the vesical symptoms were so mild that she had paid very little attention to them. Cystoscopic examination revealed a chronic cystitis. The left ureteral orifice was normal. On the right side, close

## REDUPLICATION OF THE URETER

together, were two orifices. Pyelo-ureterogram showed complete duplication on this side. There was no crossing of the ureters in this case. There was an enormous collection of calculi in both of the normal pelves. The rudimentary pelvis and its ureter were sharply dilated but seemed to be free of stones. All three pelves were infected. The functional dye output from the right lateral ureter was 4 per cent. in 15 minutes (normal 15 per cent.): from the right median



FIG. 14.  
Right pelves.



FIG. 15.  
Left pelves.



FIG. 16.—Showing course of ureters. Case VII.—Bilateral complete reduplication of ureters and pelves without pathology.

ureter a bare trace and from the left ureter 4 per cent. The condition was considered non-surgical and the patient has been lost sight of. (Figs. 10, 11, 12 and 13.)

CASE VII.—Mrs. B. D. P., white, female, married. Patient came in for investigation of cause of frequency of urination for which no explanation could be offered except a low-grade trigonitis visible through the cystoscope. Normal ureteral orifices were present on both sides and above each was a barely visible indentation suggesting possible supernumerary orifices. Probing disclosed the presence of four ureters, all of which were then catheterized. Pyelo-ureterograms (Figs. 14, 15 and 16) showed complete duplication on both sides. On the right

side the ureters crossed three times and on the left twice. The capacity of the pelvis was small and the upper pelvis presented the usual rudimentary appearance.

The functional dye output from the four ureters in 15 minutes was as follows:

R. Lower ureter 5 per cent. Upper ureter  $11\frac{1}{4}$  per cent.

L. Lower ureter 5 per cent. Upper ureter  $6\frac{1}{4}$  per cent.

No infection was present and the patient had no symptoms which could be charged to the anomaly.

*Clinical Considerations.*—It has been stated occasionally that pathologic processes are but rarely encountered in kidneys presenting duplications of the pelvis and ureter. As a general physiological proposition it would be more rational to assume the reverse, since any anomaly to some degree alters the normal body economy and thereby invites trouble. In our series of seven cases, five, or 71 per cent., presented definite pathology, namely: Infection, two cases; infection and stricture, one case; disabling pain due to obstruction by aberrant vessel, one case; multiple calculi, one case. It is true that in certain cases the pathologic process is of such a character as to indicate an independence of the associated anomaly; in certain others, however, there appears to be a definite relationship between the two. Certainly the series demonstrates the absence of any immunity to complications which appears to have been assumed in some quarters in connection with this type of case.

The diagnostic difficulties created by ureteral anomalies will be easily understood. The simple bifurcated ureter, of course, presents in the bladder no evidence of its existence and its discovery is usually accidental. Nevertheless this condition can occasion as much anatomical confusion as the ureter duplicated throughout, and, in view of its concealment from inspection, may be responsible for even greater difficulties of diagnosis than in the other types. It is wise therefore in any case in which the data is clouded by some element not obvious after the usual methods of examination to add to it a pyelogram made with a plugging catheter low in the ureter so as to demonstrate graphically the conditions existing at the other end. When the ureter is duplicated throughout and the supernumerary orifice is situated elsewhere than in the bladder, *i.e.*, in the urethra or vagina, the clinical picture and therapeutic considerations are different from those presented in this review and therefore need not be detailed further than to state that both accurate diagnosis and surgical remedy are possible. When the ureter is duplicated throughout and the supernumerary orifice is located alongside its fellow in the bladder, the only excuse for misinterpretation lies in the fact that the extra orifice is frequently so minute that under the best of circumstances it may be overlooked, while in the presence of inflammation and oedema it is altogether invisible. The essential thing to be borne in mind is that the anomaly occurs with sufficient frequency to make it imperative to include its consideration in routine cystoscopy. Ordinarily after one ureter has been located and catheterized on each side the job is considered complete, but it may be very incomplete. The writer now invariably inspects the trigone with



## REDUPLICATION OF THE URETER

especial reference to additional ureters—and in the presence of any unusual findings does so with great care. It is important to make this inspection before catheters are put into the normal ureters as the zone of congestion which sometimes encircles the orifice after catheterization may seriously obscure the field; or the third orifice may be so close to its fellow as to be completely thrown out of the line of vision by the slight elevation of the mucosa produced by the catheter. In the course of the inspection any suspicious points, however small, should be explored with a fine bougie. Quite often the supernumerary orifice is literally of pin-point size.

It will be readily seen that an infection in a third pelvis will remain untreated unless the pelvis itself is discovered. The pole of the kidney lodging the undiscovered pelvis may be the primary seat of a neoplasm or a tuberculosis, producing hæmaturia or tubercle bacilli in the urine, the source of which remains a mystery to the physician and a progressing menace to the unfortunate patient. The question of accurate diagnosis here therefore is of more than mere theoretical importance. The patient's life may hang in the balance at times. Furthermore, the presence of the anomaly may materially influence the surgical procedure. If it be accurately demonstrated in advance that a pathologic process requiring nephrectomy is present in one of a pair of pelves, the other remaining unaffected, it is entirely possible where such conservatism is warranted, to resect the involved portion of the kidney with its pelvis and ureter, leaving the remainder to continue its normal function.

## A MODIFICATION OF THE OPERATION OF BUCKNALL FOR HYPOSPADIAS

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THAT the operative procedures for the cure of hypospadias, occurring at any point from the peno-scrotal junction to the glans, are not in any great degree uniformly successful, is indicated by the number and variety of procedures described. Churchman,<sup>1</sup> as late as 1920, reviewed twelve orthodox methods or groups of methods, submitted them to a critical analysis, and found them all deficient in one or more details essential to the success of any plastic procedure.

For this criticism one is referred to the original article, but it may not be superfluous to state again the requisites of a plastic which may promise success. These are: (1) In case of failure the patient must not be left in a worse condition than originally. (2) Raw surfaces rather than cut edges must be secured for approximation. (3) Tension on tissue must be avoided. (4) Circulation of flaps must be preserved. (5) In general, flaps must be held without the aid of elaborate retention dressings as these are seldom efficient. (6) The repair of the actual defect should be done in one stage, as secondary attacks are always more difficult and less likely to succeed. (7) Flaps should be overlarge to allow for contracture in order to obtain a desirable late result. (8) The opportunity for infection should be reduced to a minimum.

A study of the orthodox procedures in the light of this critique shows only one operation which is thoroughly sound, and that is Bucknall's,<sup>2</sup> the principles of which were originally described by Landerer and Bidder. This procedure is simple and can be readily understood by reference to figure 1, in which (A) represents the lines of incision and (B) the turnback of the flap. The penis is then flexed upon the scrotum and the analogous portions of the urethral and cutaneous flaps approximated by the suture as shown in figure 2 (A) and (A'). The actual reconstruction of the urethra is thus accomplished in one stage and the secondary operation consists only in freeing the penis from the scrotum as shown in figure 3 (a) and (c). This operation was applied by both Bucknall and Churchman to the peno-scrotal hypospadias, but has not been used in those defects present on the shaft or at the base of the glans which after all comprise the larger group.

The advantages as stated by Bucknall are as follows:

(1) The operation is performed in two stages, each of which can be rapidly accomplished. (2) The skin utilized to form the roof and floor of the new urethra is not dissected up or even touched; consequently it retains its

# OPERATION OF BUCKNALL FOR HYPOSPADIAS

vitality and does not tend to slough as when flaps are used for this purpose. (3) No sutures project into the lumen of the new urethra. (4) The skin of the roof and floor of the new urethra is respectively in continuity with the roof and floor of the previously existing one. There is in consequence no tendency to the formation of a fistula or a stricture at the site of the false meatus as so frequently happens when other methods are employed. (5) No buried sutures are necessary and the apposition of the broad raw sur-

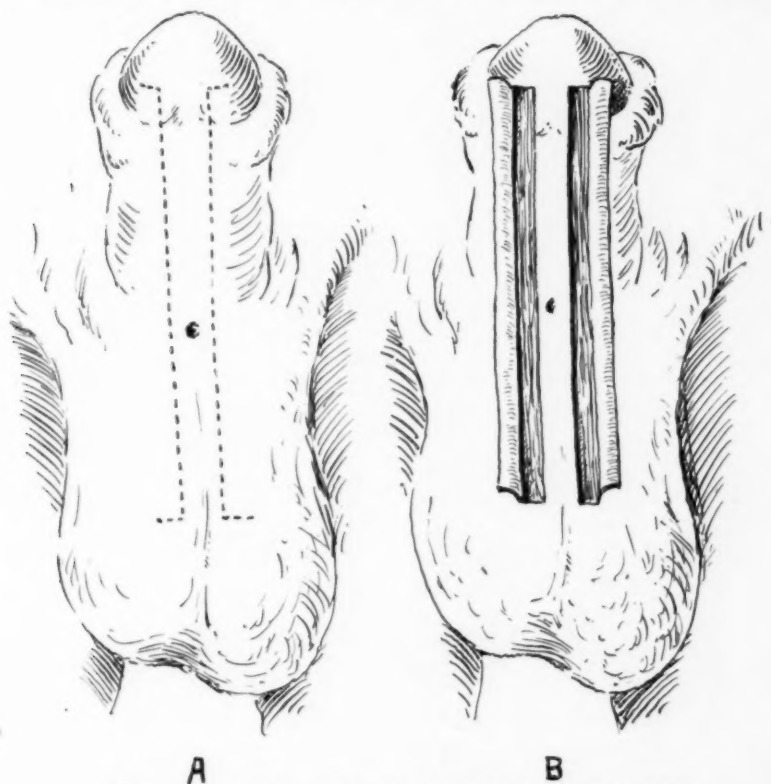


FIG. 1.—The original procedure of Bucknall. A. The lines of incision.  
B. The flaps turned back.

faces afforded by the flaps on either side supported by the rubber tubing prevents any tendency to leakage.

It is the purpose of this paper, to describe a modification of Bucknall's method as developed during the attempts at the application of this procedure in two patients with hypospadias of the shaft of the penis. The conditions which were met and the methods employed are as follows:

CASE I.—H. B., a boy of thirteen, entered the hospital with a malformation of the penis which was present at birth. He had undergone an operative procedure in another hospital some seven months previously, for a hypospadias opening directly beneath the glans at the point where the frænum is usually found. Previously to that time he had had no difficulty with urination aside from the abnormal direction of the stream. Subsequent to the interference he

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suffered from a great deal of difficulty in this respect; the urine appearing only in drops and requiring a long time and considerable effort to empty the bladder. There was also some dribbling and difficulty in retaining the urine so that he soiled his clothing most of the time. He entered the hospital for the relief of this condition and was otherwise normal.

On local examination it was evident that an attempt had been made at a plastic repair, probably of the Duplay type. The prepuce was large and redundant over the dorsum but not fused beneath the glans and the frænum was absent. Extending from the middle of the shaft to the glans was a scar resulting from

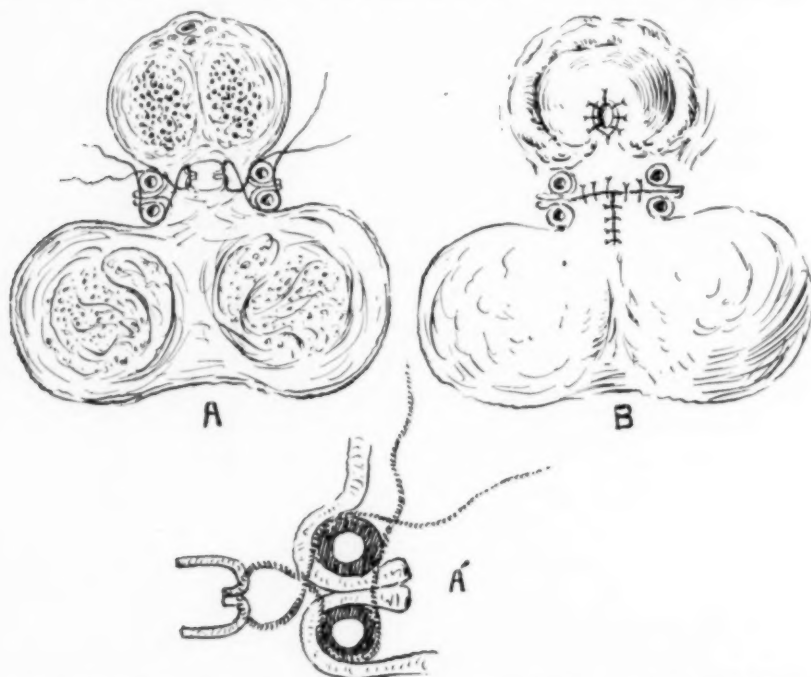


FIG. 2.—A. Penis fixed to scrotum and new urethra in cross section. B. The same, showing glans and meatus as restored by a modification of Bucknall's operation. A'. Suture in detail.

the previous operation. At the distal end of the scar was a small opening situated at the base of the glans on the ventral aspect, from which an occasional drop of urine was seen to trickle. From this point there extended a groove along the ventral aspect ending in a small depression at the normal site of the urinary meatus. On attempting to pass a filiform bougie, a stricture was met directly behind the operative meatus. The operation had resulted in carrying the opening forward on to the ventral surface of the glans, but, by reason of the stricture, had resulted in a very much worse condition than that present previous to the interference, a not uncommon result from the type of procedure used.

The indication for operation now seemed to be an attempt at cure of the stricture; consequently a filiform was introduced and an attempt made to dilate the stricture sufficiently to admit a urethrotome. It was found at once that the scar tissue and skin were so intimately adherent that inevitably such dilatation would at once rupture the urethra and adjacent skin, thus reproducing the hypospadias. There seemed no alternative to this, so the urethra was laid open as far as the scrotum and the first stage of the Bucknall procedure carried out. In other words, the anterior stricture was converted into a peno-scrotal hypos-

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padias as a preliminary to the actual repair. The convalescence was uneventful and the patient left the hospital in eleven days, discharging urine through the new urethra without any difficulty.

Four and one-half months later he was asked to return for the freeing of the penis from the scrotum. It was found that the opening of the urethra was at the base of the glans in the usual position of the frænum and that the attachment of the scrotal flaps over the lower part of the glans had not held, inasmuch as the epithelial covering of that structure was not sufficiently thick to provide viable flaps. With the freeing of the penis, then, it was necessary to carry the

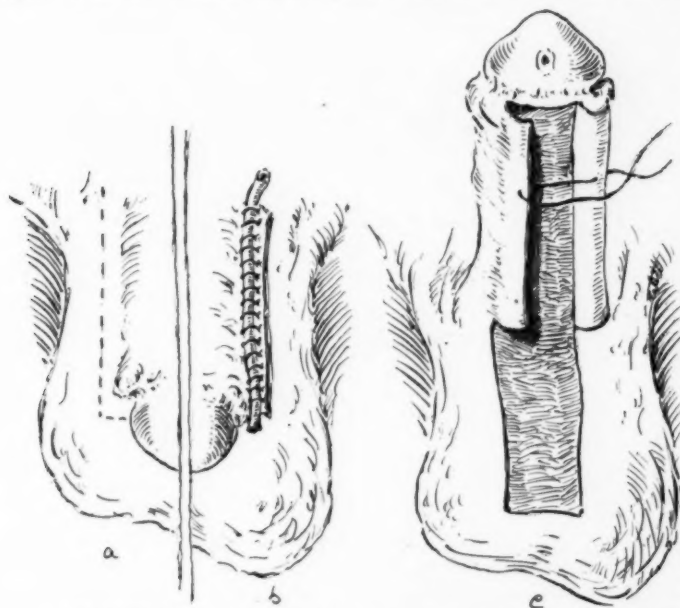


FIG. 3.—a. Line of incision for freeing the penis from the scrotum. b. The suture line following the completion of the first stage. c. Appearance following the freeing of the penis from the scrotum and previous to the suture.

new urethra to its usual site of opening on the glans. The method of accomplishing this is shown in figure 4. The penis was finally freed from the scrotum as described in the second stage of the procedure and the anterior surface reconstructed. The patient had a somewhat protracted convalescence, interrupted by an alveolar abscess but was discharged from the hospital twenty-two days after the operation with the wound healed. He voided with a large stream from the new urethral opening in the glans.

CASE II.—G. C., a boy aged eleven, entered the hospital with a hypospadias a short distance beneath the glans and a complaint of bed-wetting. The past and family histories contained nothing of significance and the physical examination revealed no abnormalities aside from that noted, which had been present since birth. The penis was of normal size and the prepuce short and retracted with a small canal at its lower edge. He was said to have been circumcised when an infant. The frænum was absent and 1 cm. beneath the glans on the ventral aspect of the penis was the opening of the urethra. At the site of the normal urethral opening there was a dimple which on probing was seen to open into a minute vestigial remnant of the urethra, leading through the glans to the ventral aspect of the penis.

Because of the facility with which a cure was accomplished in the previous case, the same procedure was carried out here. The urethra was opened to the scrotum, thus converting the deformity into a peno-scrotal hypospadias, and the first stage of the Bucknall done. Again there was difficulty in developing the flaps on the glans of the penis and consequently the new urethra ended just beneath the corona. There was a slight amount of infection which rapidly subsided and the patient was discharged sixteen days later voiding satisfactorily through the new urethra. He entered the hospital again a month and a half later for a plastic to carry the urethra through the glans. A similar method to that used in

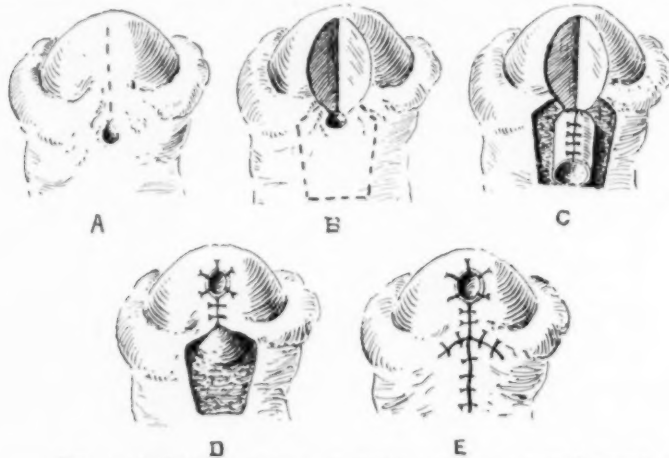


FIG. 4.—A. Incision of glans. B. Incision of flaps. C. Cuff turned up and sutured. D. Cuff inverted into opening in glans and sutured in place. E. Closure of defect made by formation of flaps.

the first case was employed but in this patient the tube of the skin was carried through the glans after dilating markedly the minute passage. The wound healed readily but with a small leak just beneath the glans. He was discharged fifteen days after the operation voiding freely from the new urethral opening in the glans with a few drops appearing at the site of the fistula. Because of attendance at school, he did not enter the hospital again until the following year, at which time the condition was much the same as on discharge. The penis was freed from the scrotum and the minute fistula touched with carbolic. The wound healed per primam and on discharge eleven days later there was no leak and a free passage through the reconstructed meatus.

The methods of attack of these two cases were not ideal, inasmuch as they were extemporized at the time and arose in part from conditions unforeseen. In two points in particular the rule for the proper performance of a plastic was transgressed. Firstly, the opening of the urethra to the base of the scrotum would, in the case of failure, leave the patient, theoretically at least, worse off than at the start. Secondly, the deferring of the reconstruction of the portion of the urethra lying in the glans until the second stage was incorrect in principle, and I believe inadvisable in practice. The original procedure of Bucknall caused the flap to be mobilized forward over the glans, but it was found practically impossible to raise flaps sufficiently thick because of the nature of the epithelial covering of the glans and as a result the urethral opening came to lie at the corona.



# OPERATION OF BUCKNALL FOR HYPOSPADIAS

The remedies for these defective steps now seem obvious. In the first place, the hypospadias does not need to be converted into a peno-scrotal lesion as regards the urethra. It is only necessary to mobilize the skin flaps as in the original Bucknall procedure and the urethra may be let alone. The method of doing this is shown in figures 5 and 6. Secondly, the reconstruction of the portion of the urethra lying in the glans is done by a modification of the Mayo method; that is, by tunnelling through the glans and the introduction of a tube formed by skin flaps obtained from the scrotum. This is best carried

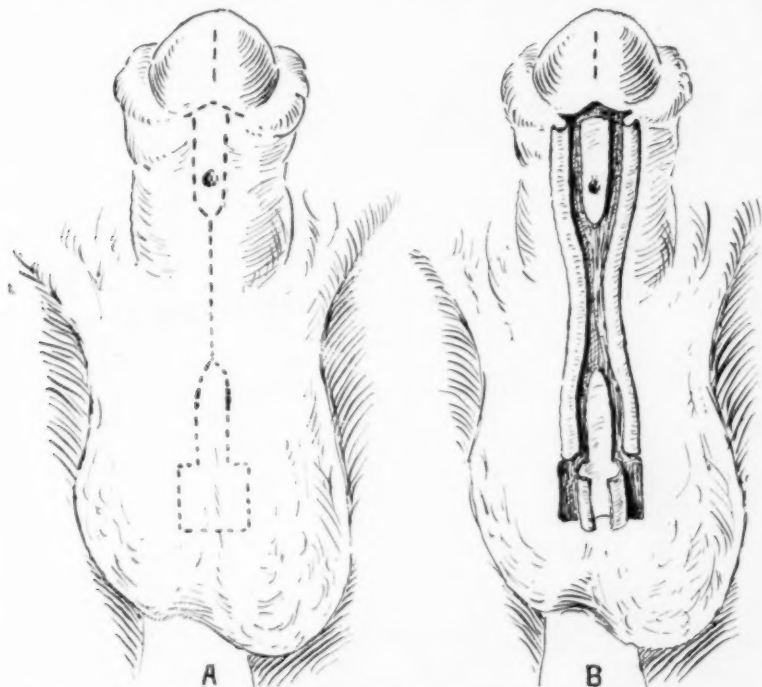


FIG. 5.—Hypospadias of shaft of penis, modification of Bucknall's operation. A. Lines of incision. B. Formation of flaps.

out during the first stage of the Bucknall procedure, and is shown in figures 5, 6, and 7. In this manner skin flaps for the new urethra can be formed with a good pedicle without any rotation and with a minimum of damage. The tube so formed will, I am sure, "take" with uniformity.

The procedures then, offering the greatest chance for success and accomplishing the greatest degree of restoration to the normal in the various types of hypospadias are as follows: In a peno-scrotal hypospadias the procedure of Bucknall with the reconstruction of the portion of the urethra in the glans is shown in figure 7. In a hypospadias with the opening in the mid-portion of the shaft, the modification as demonstrated in figure 5 and in the coronal hypospadias that suggested in figure 6.

Certain details are worth emphasizing. All skin flaps should be approximated with broad surfaces of contact and this is best done by suturing over

small rubber tubing as shown in figure 2 (A), (B), and (A'), and figure 3 (b). Sutures should not be tied too tightly but allowance made for the subsequent swelling. The suture is a figure of 8, best done with fine silk, as shown in figure 2 (A), and not passed through the new flaps of the new urethra, but at the edge in such a fashion as to invert them. These sutures are removed in from four to six days. No buried sutures are used except in the tunnel flap for the urethra in the glans, where a few double zero catgut stitches are employed, chiefly to hold the flaps in approximation while the tube is being passed through the tunnel. The slit in the glans must be made overlarge,

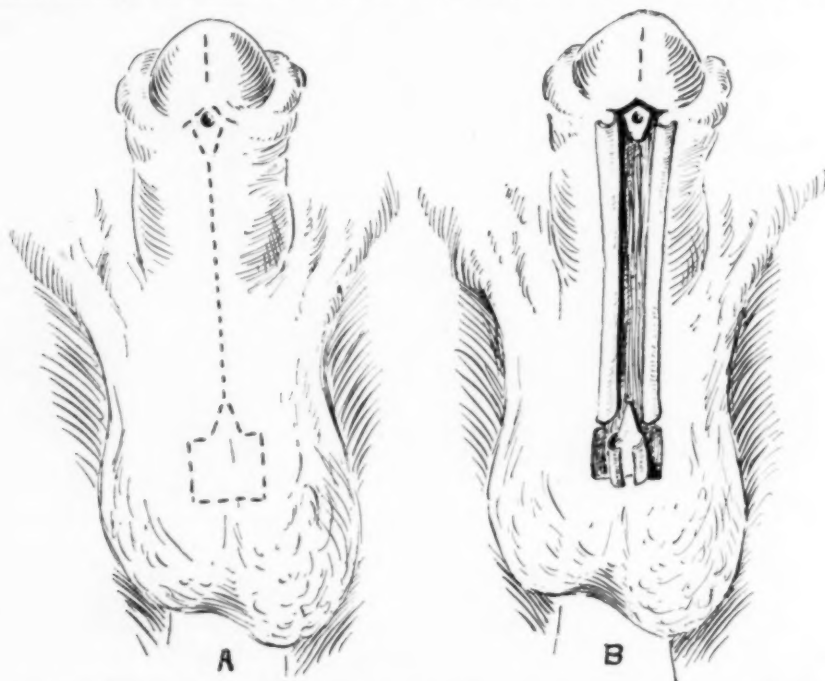


FIG. 6.—Hypospadias, coronal. Modification of Bucknall's operation. A. Lines of incision. B. Formation of flaps.

that there may be no choking of the tunnel flap when swelling takes place, and it is best to place a small soft rubber catheter through the penile urethra for 48 hours to insure the patency of this. The catheter should be fenestrated in such a fashion as to insure flow, and, if there is any suggestion of blocking, removed at once, and if necessary a small glass female catheter inserted through the glans.

The advantages of this procedure with its modifications are that it meets all the essentials of a plastic procedure and in such a fashion, that a successful result can be predicted with considerable assurance. In addition, it is not necessary to do an external urethrotomy for posterior drainage and the normal urination takes place in a few days after the first operation. There is no interference of the urinary tract in the second stage. Excessive swelling and oedema of the penis does not take place because the skin is slit to the scrotum

## OPERATION OF BUCKNALL FOR HYPOSPADIAS

so that there is no constrictor effect and resultant exaggeration of the swelling. As a consequence of this stitches do not tend to cut out nor flaps pull apart. The disadvantage of the procedure is, as far as I can determine, mainly theoretical, and that the possibility of the growth of hair in the new urethra. The scrotal flap which alone may carry hair, should be cut along the median raphé, which is nearly if not quite hairless in most individuals. For one to whom this may seem an insurmountable obstacle, depilation by the X-ray offers a ready solution.

*Summary.*—Modifications of the Bucknall operation for peno-scrotal hypospadias are described which make this principle applicable also to the penile

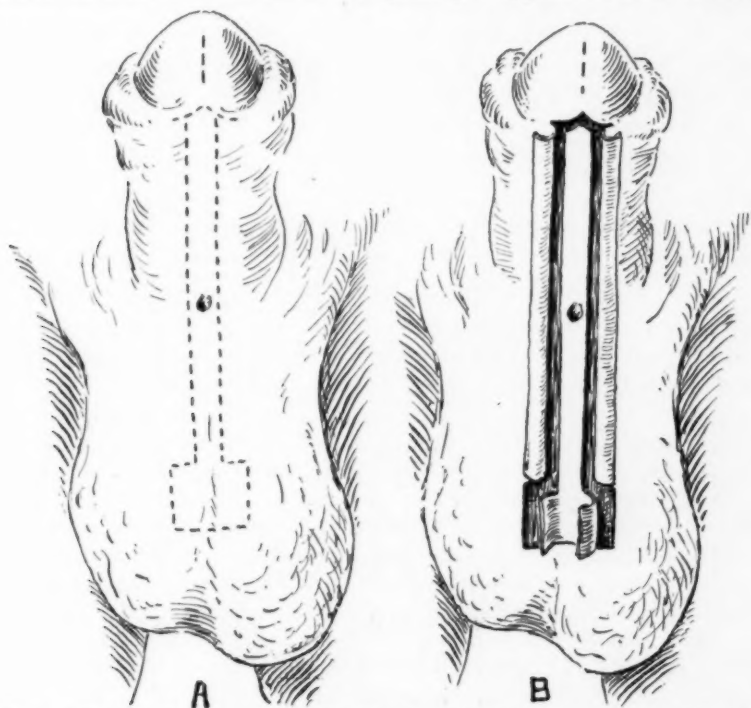


FIG. 7.—Hypospadias, peno-scrotal. Modification of Bucknall's operation. A. Lines of incision. B. Formation of flaps.

and coronal malformation of the urethra. A method is described also for carrying the distal urethra through the glans, rather than on its under surface, as originally suggested.

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## BENIGN TUMORS OF THE STOMACH

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THE occurrence of benign tumors in the stomach is rare in comparison with carcinoma of that organ. Its relative infrequency is shown by the fact that in 7500 autopsies in the Oubuchow Krankenhaus, only four cases of polyp of the stomach were found. (Quoted by Campbell.) Eusterman and Senty report 27 cases of benign tumor of the stomach under observation at the Mayo clinic between 1907 and 1921. During this period operations were performed on a total of 2168 cases of malignant disease of the stomach or a proportion of 1 to 78. Therefore 1.3 per cent. of all gastric tumors were benign. They call attention to the fact that even this percentage of frequency is relative, as during the same period 2285 additional cases of malignant neoplasms, the majority of them inoperable, passed through the clinic.

During the period between 1910 and December 31, 1921, 170 cases of carcinoma of the stomach were operated on in St. Luke's Hospital. There were four cases in which benign tumor of the stomach were found at operation. One other case that had no operation is reported from autopsy. The following is a brief report of these cases:

*Case Reports:*—CASE I.—M. C. No. 108833, a woman sixty-seven years old, was admitted to the hospital, September 27, 1915. She gave a history of anorexia, dizziness, loss of strength and the loss of 14 pounds weight in the previous two or three months. She had slight nausea at times but never vomited. She complained of feeling heavy after eating and of frequent attacks of diarrhœa. Gastric analysis showed an absence of free hydrochloric acid. A radiograph, which was taken previous to her admission to the hospital, showed a peculiar mottling due to various filling defects throughout the stomach which was most marked in the pars media. This picture is now recognized as characteristic of gastric polyposis, as shown excellently in the radiograph of the case reported by Balfour. But as the case here reported was under observation previous to any report of similar cases, the diagnosis of carcinoma of the pars media of the stomach was made.

An exploratory operation was done and the stomach found free from adhesions or induration, but palpation demonstrated the presence of small soft masses inside the stomach as if it were full of undigested particles of food. Incision through the anterior stomach wall showed almost the entire mucosa covered by adenomatous polypi, varying in size from a small pea to a large grape, most marked in the middle portion of the stomach. The masses were soft and friable, some single, some in bunches of three or four. A number of these polypi were ligated at the base and removed for examination. It was obvious, that, as practically the whole stomach was involved from the cardia to the pylorus, a resection was impossible.

Radium treatment was attempted by means of enclosing 60 mm. of radium in a capsule to which a string was attached. The patient swallowed this capsule

## BENIGN TUMORS OF THE STOMACH

and it remained in the stomach for six hours, her position being changed from time to time to bring the radium into contact with various portions of the stomach. That this was accomplished, was demonstrated by a number of radiographs which were taken with the patient in different positions.

Microscopical report of the specimens removed is as follows: "There is hyperplasia of the mucosa with congestion of the blood-vessels. The glands are greatly increased in number and in tortuosity, with many cystic dilatations in their ducts. Cylindrical cells line them. There is a small amount of fibrous stroma throughout the mucosa."

The patient had severe pain at times, following operation, vomited occasionally and for two or three weeks after operation had diarrhoea which was difficult to control. She left the hospital about a month after the operation but died three months later; her pre-operative symptoms continuing and gradually becoming worse, up to the time of her death.

CASE II.—P. C., No. 114,979, a man forty-four years old, was admitted to the hospital, August 16, 1916. He never had any symptoms up to three or four months previous to his admission to the hospital. He then had indigestion and vomited three or four times during the three months when he ate solid food. He complained of no pain but lost 18 pounds in weight. Examinations showed a mass in the epigastric region and the radiograph a 24 hour residue and filling defect. Diagnosis of carcinoma of the stomach was made and gastric resection done. There was a large ulcerating carcinoma in the pyloric portion of the stomach, and at a distance from this carcinoma on the posterior wall of the stomach, separated from the edge of the carcinoma by an area of normal mucosa, was a papillomatous growth about one centimeter in diameter.

This patient improved after operation, gained 27 pounds in weight and felt as well as ever, but shortly after this time he began to again lose weight and strength, and died about 15 months after operation of a recurrence.

CASE III.—W. D., No. 133,514, a man fifty years old, entered the hospital, February 7, 1919. He gave a gastric history of eight months duration. There was retention of bismuth in the stomach for six hours and a filling defect of the lesser curvature, but no mass could be felt. Pre-operative diagnosis was gastric carcinoma. Operation revealed a large callous ulcer on the lesser curvature which was adherent to the surrounding structures and a gastro-enterostomy was determined on. The interior of the stomach was examined through the gastro-enterostomy opening. A papilloma about 1.5 cm. in diameter was found attached to the anterior wall of the stomach near the pylorus, surrounded by normal mucous membrane. The papilloma was excised and its base sutured with chromic catgut and a posterior gastro-enterostomy performed. Pathological report showed a characteristic adenopapilloma of the stomach. The patient vomited a large amount of brownish fluid, evidently containing blood, for several days following the operation. He had repeated attacks of hiccough and died on the ninth day after operation. Whether the post-operative hemorrhage was from the base of the papilloma, his ulcer, or the gastro-enterostomy stoma, was never determined, as no autopsy was permitted.

CASE IV.—K. S., No. 135,150, a woman fifty-two years old, entered the hospital, April 28, 1919, with a four months' history which was characteristic of cholelithiasis. At operation a large stone and several smaller stones were found in the gall-bladder and a cholecystectomy was done. On the anterior wall of the pyloric portion of the stomach was a small white subserous tumor about .5 cm. in diameter which was excised, apparently a fibroma. Macroscopically, the tumor seemed circumscribed, but microscopically could be seen invading the muscle tissue on all sides and contained a small area of cystic degeneration at its periphery. Diagnosis was fibroma of the stomach wall.



The first case reported of gastric polyposis presents, according to Eusterman and Senty, the rarest form of benign tumor of the stomach, the only case reported in their article being the one described in detail by Balfour, in which case the multiple polypi appeared to be confined to the pyloric end of the stomach. In writing of this case, Eusterman states that Carman had only seen two cases in 50,000 Röntgen-ray examinations of the stomach, one case reported by Balfour and the other by Meyer. H. E. Ruggles has also reported a case of "Unusual Gastric Polyp." This tumor was described as of papillomatous rather than adenomatous structure.

J. N. T. Finney and J. Freedwald have reported two cases of gastric polypi which had undergone malignant degeneration. This is of interest in

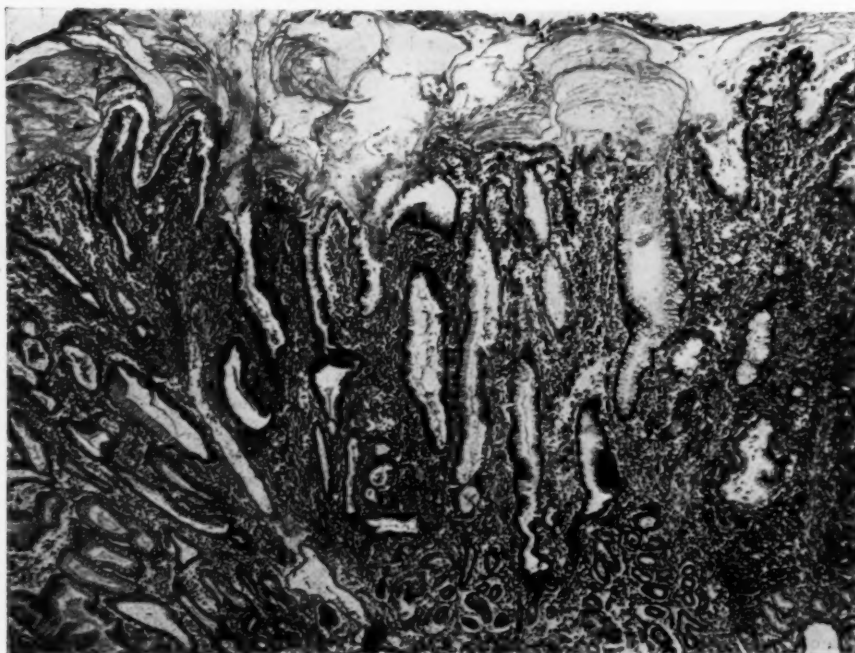


FIG. 1.—Case I. Gastric polyposis. High power.

connection with Cases II and III, in the series reported in this article. In Case II, a single papilloma was found in the patient operated on for carcinoma. While at a distance from the carcinoma, it is not impossible that the carcinoma originated in another papilloma of the stomach, although this cannot be proved. In Case III, the papilloma was at a distance from a large callous ulcer on the lesser curvature. This patient died as a result of his operation. No autopsy was allowed and it is not known whether the ulcer was carcinomatous or not. In the two cases reported as "gastric polyposis" by Finney and Friedenwald, there was a single papillomatous mass in each case. In both cases carcinoma had developed, and as these cases differ both macroscopically and microscopically from the multiple polypoid growths



## BENIGN TUMORS OF THE STOMACH

described in Case I and in the reported cases of Balfour and Meyer, they should not be reported as gastric polyposis.

Macroscopically the tumors found in gastric polyposis appear smoother, are more sessile than the papillomatous growths, and resemble grossly polypi, such as are found in the uterus or nasal cavity. Microscopically the difference is well described by the following report by Dr. L. C. Knox, resident pathologist of St. Luke's Hospital. This report also explains why the papillomatous growths are apt to become malignant while the polypoid growths are less likely to do so.

"In the polypoid adenoma from Case I, we have small, rounded, sessile tumors, the surface covered with rather shallow glands showing only hyper-



FIG. 2.—Case III. Adenopapilloma. High power.

plasia extending not below the muscularis mucosa and composed of comparatively regular acini, lined with epithelium which is hyperplastic but closely resembles the mucosa of the normal stomach and show no tendency to infiltrate. These cells are distended with very large quantities of mucus which also covers the surface. (Fig. 1.) The specimen of papillary tumor from Case III has a small base, is composed of extremely irregular glands, lined with epithelium which does not resemble the normal and tends to produce very little mucus, the greater portion of the cell body being occupied by the nucleus which is itself large, irregular, and deeply stained. Although infiltration of the basement membrane cannot be seen, the acini are comparatively elongated and irregular and this frequently suggests infiltration where it cannot be proven." (Fig. 2.)

The following case report of a patient dying in the medical ward of the hospital in the service of the late Dr. A. W. Hollis, is of considerable interest in relation to the degeneration of benign papillomata: such as is described in the cases of Finney and Friedenwald:

CASE V.—H. S., No. 136,341, a man thirty-eight years of age, was admitted to the medical ward of the hospital on June 23, 1919. He complained of pain in the abdomen, relieved by food. He never vomited. He had marked weakness and had been unable to work for the previous six or seven months. There was an absence of free hydrochloric acid in the stomach, there was blood in the stools, and a radiograph showed two areas of lessened density in the stomach but no diagnosis was made. There was no six-hour gastric residue. His hæmoglobin was 29 per cent. and red blood cells, 2,800,000. Morphology of the blood showed pernicious anæmia. He improved while in the hospital under transfusions and other treatment, and left the hospital after three months to go to the country and convalesce. He returned three months later to the hospital. Although his anæmia was much improved, he still had blood in his stools and no free hydrochloric acid in the stomach. About one month after admission he developed a high temperature, some abdominal rigidity and finally died, 22 days later. At autopsy it was found that he had a low grade peritonitis which had apparently spread from a small perforation in the stomach. There were a number of papillomata growing from the stomach mucosa. And the most interesting finding was that while microscopical examination of these papillomata indicated no malignancy, the regional glands showed carcinomatous metastases.

The last case reported, Case IV, that of fibroma, was a purely accidental finding, as it caused no symptoms, the patient being admitted and operated upon for cholelithiasis. These tumors, however, frequently attain a large size.

Histologically, benign tumors of the stomach may be of almost any type. In Eusterman's series there were three leiomyomata, three adenoleiomyomata, four fibromyomata, five fibromata, four hæmangiomata, two dermoids, one case of polyposis, two adenomata, two adenomatous polypi and one case of multiple papilloma.

Myomata of the stomach are apparently among the most common of benign tumors as, in addition to the ten cases of different types of myoma reported by Eusterman and Senty, Farr and Glenn collected 84 cases in 1913, and F. Nasetti in 1914 brought the number of cases of leiomyomata of the stomach reported up to 140. These tumors may reach a large size, as the one of 6000 gms., reported by Perls and Neelsen, and are apt to become cystic and undergo sarcomatous degeneration. In addition to tumors of the histological types previously mentioned, lipomata, usually of small size, have been reported by Virchow, Von Russdorf and Benaky. They may be single or multiple.

In the vast majority of cases pre-operative diagnosis is not made, as there is little that is characteristic, with the exception of the radiographic picture caused by gastric polyposis. In many instances the tumor is found as a result of an operation for some other condition, although pyloric stenosis may be caused, and Wade has reported a case in which intussusception into the stomach and the duodenum was due to a pedunculated fibro-adenoma. Cases in which an adenomatous polyp obstructed the pylorus have been

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reported by Tuffier, Chiari, and by Cornil as early as 1863, and by Chaput, Gibson, and Blake. Fenwick reported a case in which four pedunculated adenomata of pigeon-egg size, attached near the pylorus, caused partial obstruction. In addition to causing pyloric obstruction such adenomatous polypi may cause continued hemorrhage of a sufficient degree to resemble pernicious anæmia and undergo carcinomatous degeneration, as shown by the case record and autopsy reported in this article, Case V.

Portions of polypi have been found in the stools, vomitus and lavage from the stomach and diagnosis made thereby. There is usually achylia gastrica as a symptom in the various types of polypoid growths in the stomach, and the vomitus or lavage return frequently contains a large amount of mucus and attention has been called to the peculiar egg-white appearance of this mucus. Benign tumors of the stomach may occur at any age, and in Eusterman and Senty's series, an equal number of cases were found in patients above and below the age of forty.

*Summary.*—1. Five cases of benign tumor are reported. One of multiple polyposis, three of papillary adonema, of which one had undergone malignant degeneration, and one fibroma. The patients' ages varied from thirty-eight to sixty-seven.

2. Almost any type of benign tumor which might take its origin from the different stomach layers may be found. The various forms of myomata have been most frequently reported and appear to attain the largest size. Multiple gastric polyposis is the least frequently met with. The myomata and fibromyomata may become cystic or undergo sarcomatous degeneration. The papillary adenomata may become carcinomatous. There is a histological difference between the true multiple polypoid tumors and the papillary adenomata.

3. A pre-operative diagnosis is infrequently made, the smaller tumors usually causing no symptoms. The radiographic appearance of gastric polyposis, and the achylia gastrica with the egg-white mucus in the lavage return, however, is characteristic of this lesion. In other forms of benign tumor the symptoms or diagnosis may depend on a palpable tumor, anæmia due to repeated hemorrhages, or the appearance of a portion of the tumor in the vomitus, stool or lavage return. Symptoms of pyloric obstruction may result from a tumor in the region of the pylorus. Intussusception through the pylorus has been reported in two cases.

4. There is nothing characteristic or diagnostic to be learned from gastric analysis except in multiple polyposis, as it varies from achylia gastrica to hyperacidity.

5. Radiographic examination shows a six-hour residue less frequently than in cases of carcinoma except in the case of tumors which obstruct the pylorus. A large tumor would cause the same radiograph picture as is shown by a carcinoma. Occasionally a persistent defect might cause the suspicion of a tumor as in Case V, or an extragastric tumor may cause a defect in the outline of the stomach.

6. A generalization or summary of the operative indications is difficult, as benign tumors differ in histology, size, as to whether they are extrinsic, intrinsic, infiltrating or pedunculated, are symptomless or causing any of the symptoms described, or are of the types which may undergo malignant degeneration. Surgical removal of the tumor should be done when indicated by symptoms, or when diagnosis can be made either before or at the time of operation. With the exception of those cases in which multiple tumors are present, the technical difficulty is usually less than in malignant disease, because of absence of infiltration and ulcerations, and metastases in regional glands. The ultimate prognosis is better, as if the benign tumor is successfully removed, recurrence will not occur.

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## GALL-BLADDER DISEASE IN CHILDHOOD

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GALL-BLADDER infection has usually been considered a disease of middle age. It is the purpose of this paper to show that the condition is by no means as infrequent in early life as supposed, that it can usually be diagnosed if kept in mind, and to review the literature of the subject.

In September, 1921, the following case came under my care in Gouverneur Hospital.

*Case Report.*—J. B., female, aged eleven, born in Poland. Family history negative. Previous history: One previous attack, never had typhoid nor other infectious disease. Present illness commenced three days ago with constipation, nausea, vomiting and general abdominal pain, most severe in upper right quadrant.

*Examination.*—Temperature 100.4, pulse rapid. The child was evidently in severe pain which was referred to the epigastrium and upper abdomen. There was general tenderness more marked about the navel and under the right costal arch, and general rigidity particularly of the upper right rectus. There was no jaundice.

Immediate operation was performed. Through a right rectus incision the appendix and gall-bladder were inspected and excised. The former was thickened and adherent. It was evidently the seat of chronic inflammation. The latter was thickened, oedematous, imbedded in adhesions, and contained thick dark bile with fifty-two gall-stones, several of them the size of a pea. Recovery was uneventful and complete.

This experience led to a review of the literature of cholecystitis and cholelithiasis in childhood, starting with a report by Gibson<sup>1</sup> in 1722. Sixty-four cases have been collected. It is probable that there are many others which have not been recorded.

In the United States no attention has been paid to the subject beyond a recent valuable paper by Farr<sup>48</sup> (1922) and the case reports of Eisendrath<sup>40</sup> in 1917. In England Thompson<sup>28</sup> (1898) and Still<sup>29</sup> (1899) have written briefly but interestingly on the subject and Thudichum in his treatise on gall-stones (1863) discussed the etiology.

In Germany a few cases have been reported and a brief review was published by Khautz<sup>41</sup> in 1913.

The French writers have given more attention to the subject and the papers of Massie<sup>19</sup> (1880), Mercat<sup>22</sup> (1884), Serveniere<sup>42</sup> (1889) and Mangin<sup>15</sup> (1869) are worthy of study.

The appended table presents a summary of sixty-three cases abstracted from the literature of the subject together with the author's case now reported.

*Statistical Summary.*—SEX.—Male, 25; female, 18; not stated, 21. Total, 64.



TABLE PRESENTING SUMMARY OF ABSTRACTED CASES

No. of case	Date	Author	Sex	Age	Autopsy	Operation	Stones	Jaundice.	Cholecystitis	Other pathology	Other symptoms	How diagnosed
1	1722	Gibson	Male	12 yrs.	Yes	No	Yes	No	No	Ascites	Pain, loss of weight and strength, vomiting	Autopsy.
2	1752	Coe	Unknown	Under 12 yrs.	.....	.....	Yes	.....	.....	.....	.....	.....
3	1767	Lientaud	Male	25 days	Yes	No	Yes	.....	.....	Liver enlarged	Colic	Autopsy.
4	1813	Portal	Unknown	Infant	Yes	No	Yes	Yes	.....	Liver infiltrated with blood	.....	Autopsy.
5	1813	Portal	Unknown	Infant	Yes	No	Yes	Yes	.....	Liver infiltrated with blood	.....	Autopsy.
6	1813	Portal	Female	15 yrs.	Yes	No	Yes	Yes	No	.....	Indigestion, depression, oedema-limbs	Autopsy.
7	1822	Beverhoyt	Male	13 yrs.	Yes	No	Yes	.....	.....	.....	.....	.....
8	1822	Beverhoyt	Unknown	Under 13	.....	No	.....	.....	.....	.....	.....	.....
9	1829	Du Cruveilhier	Unknown	5-6 mos.	.....	No	Yes	.....	.....	.....	Tuberculosis	.....
10	1829	Du Cruveilhier	Unknown	Very young	.....	No	Yes	.....	.....	.....	.....	.....
11	1830	Orfila	Female	14 yrs.	Yes	No	Yes	Yes	Yes	.....	Constipation, abdomen swollen, rigid, tender—severe pain	Stones found in faeces.
12	1834	Lolatte	Male	15 yrs.	No	No	Yes	.....	.....	.....	.....	.....
13	1838	Valleix	Unknown	Newborn	Yes	No	Yes	.....	.....	.....	.....	Autopsy.
14	1838	Valleix	Unknown	Newborn	Yes	No	Yes	.....	.....	.....	.....	Autopsy.
15	1838	Valleix	Unknown	Newborn	Yes	No	Yes	.....	.....	.....	.....	Autopsy.
16	1843	Bouisson	Unknown	Newborn	Yes	No	Yes	Yes	.....	Commencing obliteration common duct, thick black bile	.....	Autopsy.
17	1861	Trousseau	Female	9 yrs.	No	No	No	.....	.....	.....	Typical symptoms of gall-stones	From symptoms.
18	1861	Wolf	Male	10 yrs.	No	No	Yes	.....	.....	.....	.....	Stones observed in faeces.
19	1861	Frerich	Female	7 yrs.	Yes	No	Yes	.....	.....	Lardaceous disease of liver	.....	Autopsy.
20	1864	Royer	Unknown	5 yrs.	Yes	No	Yes	No	No	Peritonitis, perforated appendix, ducts dilated	Symptoms of peritonitis	Autopsy and analysis of calculi.
21	1869	Mangin	Female	11 yrs.	Yes	No	Yes	Yes	Yes	.....	Attacks of colic with intermittent fever	Autopsy.
22	1870	Senac	Unknown	5-10 yrs.	.....	.....	.....	.....	.....	.....	.....	Diagnosis made with certainty.
23	1870	Senac	Unknown	5-10 yrs.	.....	.....	.....	.....	.....	.....	.....	Diagnosis made with certainty.
24	1870	Senac	Unknown	5-10 yrs.	.....	.....	.....	.....	.....	.....	.....	Diagnosis made with certainty.
25	1877	Cuffer	Male	12 days	Yes	No	Yes	Yes	Yes	Gall-bladder reduced to size of small duct. Cystic and common duct obstructed by calculi	Hæmophilia	Autopsy.



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1879	Andard	Unknown	Under 4 yrs.	No	No	Yes	Yes	.....	.....	Colic	Stones in faces.
26	1880	Female	4-5 yrs.	No	No	Yes	Yes	.....	.....	Symptoms as in adults	Stones expelled.
27	1880	Male	8 yrs.	No	No	No	No	.....	.....	Hepatic colic quite characteristic	From symptoms.
28	1880	Unknown	8 mo. fetus	Yes	No	Yes	Yes	.....	.....	.....	Autopsy.
29	1880	Male	3 mos.	No	No	Yes	Yes	.....	.....	Colic	Stones in faces.
30	1882	Male	10 yrs.	No	No	No	No	.....	.....	Attacks of severe epigastric pain, vomiting, tenderness over gall-bladder	From symptoms.
31	1884	Male	11 yrs.	No	No	No	No	.....	.....	Biliary colic, fever, enlarged liver	From symptoms.
32	1884	Male	3 yrs.	No	No	Yes	Yes	.....	.....	Abdominal pain, enlarged liver	From symptoms.
33	1884	Male	3 yrs.	Yes	No	Yes	No	.....	.....	Symptoms of peritonitis	Calculus in appendix recognized as biliary calculus.
34	1884	Male	Under 4 yrs.	No	No	Yes	Yes	.....	.....	Colic	Stone in faces.
35	1884	Male	10 yrs.	Yes	No	Yes	Yes	.....	.....	Symptoms of typhoid fever	Autopsy. This was a case of empyema of gall-bladder secondary to the typhoid.
36	1884	Male	Infant	Yes	No	Yes	Yes	.....	.....	.....	Autopsy.
37	1891	Female	14 yrs.	No	No	Yes	Yes	.....	.....	.....	Stones found at operation.
38	1892	Female	10 yrs.	No	No	Yes	Yes	.....	.....	Indigestion, vomiting, abscess of back from which calculus was discharged	Stone recognized.
39	1892	Unknown	20 days	Yes	No	Yes	Yes	.....	.....	Abdominal pain, light stools, weakness	Autopsy.
40	1898	Male	9 mos.	Yes	No	Yes	No	.....	.....	Vomiting, constipation, purpura	Autopsy.
41	1899	Female	8 mos. 5 mos.	Yes	No	Yes	Yes	.....	.....	Cerebral symptoms	Autopsy.
42	1899	Female	10 yrs.	No	No	No	No	.....	.....	Severe abdominal pain, pale stools, palpable liver	Symptoms.
43	1899	Male	9 yrs. 13 yrs.	No	Yes	No	No	.....	.....	Vomiting, abdominal pain, enlarged and palpable gall-bladder	Operation—no stones.
44	1899	Male	5 yrs.	No	Yes	Yes	Yes	.....	.....	Acute cholecystitis	Operation—no stones.
45	1905	Male	4 mos.	Yes	No	Yes	Yes	.....	.....	.....	Operation.
46	1909	Female	4 mos. 5 yrs.	Yes	No	Yes	Yes	.....	.....	Fever, colic, palpable tumor	Operation.
47	1908	Male	13 yrs.	No	Yes	Yes	Yes	.....	.....	Abdominal pain	Operation.
48	1908	Unknown	4 mos.	Yes	No	Yes	Yes	.....	.....	Pain, tenderness, palpable tumor	Operation.
49	1908	Unknown	5 yrs.	Yes	No	No	No	.....	.....	.....	Operation.
50	1909	Male	13 yrs.	No	Yes	Yes	Yes	.....	.....	.....	Operation.
51	1909	Female	13 yrs.	No	Yes	Yes	Yes	.....	.....	.....	Operation.

TABLE PRESENTING SUMMARY OF ABSTRACTED CASES—(Continued)

No. of case	Date	Author	Sex	Age	Autopsy	Operation	Stones	Jaundice	Cholecystitis	Other pathology	Other symptoms	How diagnosed
52	1909	Wharton	Male	13 yrs.	No	Yes	No	No	Yes	Pus in gall-bladder. Acute appendicitis	Pain and tenderness in right hypochondrium, palpable gall-bladder	Operation, empyema of gall-bladder without stones, complicating appendicitis. Autopsy or operation.
53	1909	Stoelzner	Male	7½ yrs.	.....	.....	Yes	.....	.....	.....	.....	.....
54	1910	Neuman	Female	14 yrs.	No	Yes	Yes	.....	.....	.....	.....	Operation.
55	1910	Childs	Female	13 yrs.	No	Yes	No	.....	Yes	.....	.....	Operation.
56	1912	Marton	Unknown	2½ yrs.	No	Yes	No	.....	Yes	Much distended gall-bladder	Supposed intestinal obstruction	Operation, cholecystitis without stones.
57	1917	Eisendrath	Female	15 yrs.	No	Yes	Yes	Yes	Yes	Gall-bladder tense	Colic, temperature, rigidity	Operation.
58	1917	Eisendrath	Female	15 yrs.	No	Yes	Yes	.....	Yes	Chronic appendicitis	Severe pain upper right quadrant, vomiting, tenderness, palpable gall-bladder, catarhal appendicitis	Operation.
59	1922	Farr	Male	13 yrs.	No	Yes	No	Yes	Yes	Appendicitis	Fever, pain, rigidity, tenderness	Operation.
60	1922	Farr	Male	8 yrs.	No	Yes	No	No	Yes	Appendicitis	Scarlet fever, tenderness, rigidity upper right quadrant	Operation.
61	1922	Farr	Male	8 yrs.	No	Yes	No	No	Yes	Multiple abscesses liver	Vomiting and pain, fever, leucocytosis	Operation.
62	1922	Farr	Male	7 yrs.	No	No	No	Yes	Yes	Ascites	Vomiting, chills, fever	From symptoms.
63	1922	Farr	Male	12 yrs.	No	Yes	No	No	Yes	Appendicitis	Pain, vomiting, tenderness, leucocytosis, fever	Operation and symptoms.
64	1922	Kellogg	Female	12 yrs.	No	Yes	Yes	No	Yes	Appendicitis	Fever, pain, rigidity, tenderness	Operation and symptoms.

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AGES.—Fœtus (8 months), 1; newborn, 7; very young, 1; infant, 3; child, 1; less than 1 year, 6; between 1 and 5 years, 7; between 5 and 10 years, 13; between 10 and 15 years, 25. Total, 64.

CALCULI.—Present, 44; absent, 10; not stated, 10. Total, 64.

JAUNDICE.—Present, 16; absent, 16; not stated, 32. Total, 64.

CHOLECYSTITIS.—With stones, 12; without stones, 11; absent, 4; not stated, 37. Total, 64.

A study of these reports which cover the literature up to the present time shows that we can place the cases in three groups: Gall-stones in early infancy, gall-stones of later childhood, acute infections of the gall-bladder of hæmatogenous origin.

Still<sup>29</sup> has the following to say of the first group:

"As regards the etiology of gall-stones in childhood, one point seems to be of special importance, namely, the much greater tendency to formation of gall-stones during early infancy than in later childhood. It seems quite certain that in many, if not in all of the newborn cases, the calculi have actually been formed during intra-uterine life.

"It would appear therefore that some condition is present during intra-uterine life and early infancy which particularly favors the production of biliary concretions. This condition is perhaps to be found in the tendency to stagnation of bile in the gall-bladder which seems to exist at this period.

"In making a considerable number of autopsies on infants it has struck me, as it seems to have struck several of the writers on the anatomy of childhood, that the bile in the gall-bladder is often very viscid in early infancy, and such a viscosity would naturally favor, if indeed it be not the result of stagnation. That a mechanical hindrance which causes a stagnation of bile may be associated with the formation of calculi is shown by the cases in which a narrowing of the common duct was associated with the presence of calculi. Moreover, a potent cause of stagnation may exist in the muscular inactivity of this period: the contractions of the diaphragm in particular are probably completely in abeyance during intra-uterine life and the general movements of the body are extremely slight."

There are three cases in this group in which at autopsy the common duct was found to be obstructed. It is possible that a similar lesion in other cases has been overlooked.

The cholelithiasis of later childhood does not appear to differ from that in adults. It is apt to be wrongly diagnosed because we are prone to regard gall-bladder infection as a disease of middle age. The possibility being kept in mind, it should offer only the ordinary difficulties of diagnosis.

Acute infections of the gall-bladder without the presence of gall-stones have been particularly stressed by Farr. Apparently it is usually a result of bacteriæmia secondary to some other infection, but in some of the cases no other infection could be found. It is necessary to remember that it may occur, as it creates a surgical problem of great importance.

The observations gathered are sufficiently numerous to indicate the importance of considering this affection, which is barely touched upon by the classical authors of diseases of childhood, and to lead to the conclusion that it is not so rare as has been generally believed.

*Summary.*—Sixty-four cases are reported. They are grouped under three headings: Cholelithiasis of early infancy. Cholelithiasis of later childhood. Cholecystitis without gall-stones.

Cholelithiasis in the newborn appears to be due to an unknown fetal pathology and is usually fatal.

Cholelithiasis of later childhood does not differ from that in adults, but is often wrongly diagnosed because this lesion is not considered.

Cholecystitis without gall-stones is an important surgical problem.

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## COMBINATION ILEUS, OR THE COINCIDENCE OF TWO INTESTINAL OCCLUSIONS

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COMBINATION ileus has been defined by Hochenegg as the coincidence of two acute occlusions of the intestinal tract, one being primary, but becoming clinically evident only on the appearance of a secondary, superimposed occlusion. The reciprocal action of these two obstructions may cause a variation in the development of the clinical picture. The primary cause of the occlusion may be an obturation—a fecal impaction, a gall-stone, a foreign body, a new growth; or we may find a strangulation of the gut—incarceration, volvulus, band, diverticulum, in both instances a mechanical ileus. A paralyzed intestine in a case of peritonitis may also act as a primary cause (dynamic ileus). The secondary cause of the occlusion, situated in most instances oral to the primary cause, is generally an old hernia, presenting the clinical signs of incarceration; but it can also be an additional internal strangulation (hernia, band, volvulus). Clinically, a complete obstruction is present at one place; a second coexistent may only be suspected.

The first clinical impression is that of a complete occlusion at the point, where later on one cause of a combination ileus is discovered; the underlying pathological findings do not confirm the diagnosis as complete. In such cases at the time of first operation the changes at the place of apparent obstruction explained the symptoms to the satisfaction of the operator. The persistence of the ileus symptoms demonstrates that in these cases a second complete obstruction must be present distal (aboral) to the first one removed at the first operation. A second or even a third operation is necessary, until the real primary factor is eliminated. These different surgical procedures follow one another generally within a few days, exceptionally within months. This clinical entity of combination ileus has not been given the place in the literature which it deserves because of the prognostic outlook for the patient. The incidence of these cases is not so uncommon as the relatively few references in the literature might lead us to believe. The importance of accurate knowledge of the clinical picture of this special form of ileus justifies a brief review of the literature, together with a report of some personal experience; and it is hoped that this essay may arouse more interest in an important form of intestinal occlusion and be an impetus for the publication of more cases.

*Historical Notes.*—A review of Hochenegg's observation might form the starting point. Its record is impressive and gives a vivid illustration of fallibility in the diagnosis of this form of ileus. It also demonstrates the correctness of the nomenclature introduced by Hochenegg.



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*Case Report.*—A man, fifty-two years of age, had suffered for years from flatulence and indigestion. Constipation became more marked. A stay in Carlsbad did not bring relief. During the summer of 1893, the patient often had attacks of colicky pains of short duration in the left upper quadrant of the abdomen. In October, 1893, following a heavy meal, patient developed the symptoms of an acute intestinal occlusion. The diagnosis of a new growth at the ileocaecal angle was made. A laparotomy was performed (Hochenegg) and a band was found constricting the lowest part of the ileum three finger-breadths above the ileocaecal junction; the colon was empty. This band was resected and an enterostomy of the dilated small intestine was found suitable. Uneventful recovery followed. The enterostomy fistula closed spontaneously.

In April, 1894 (six months later), patient had vomiting spells of one to four days duration. For intervals of two to four weeks he was without any symptoms. These symptoms of obstruction were attributed to a kinking and narrowing of the intestine by scar-tissue at the site of the former enterostomy. The persistent symptoms necessitated a resection of this part of the small gut in January, 1895. A marked hypertrophy of the wall of the transverse colon as compared with the musculature in the sigmoid flexure was noticed at this operation. No further attention was paid to this unusual fact. Patient made a rapid and uneventful recovery.

In September, 1895 (eight months after the second operation), new symptoms of acute intestinal obstruction recurred; vomiting spells were accompanied by diarrhoea. A third laparotomy was performed in February, 1896. An encircling hard new growth at the splenic flexure of the transverse colon was found. Patient died a short time after this operation.

This tumor, in its early stage, was presumably the primary cause of all these ileus-attacks. A second, accessory factor, oral to this first one, was superimposed, and predominated in the clinical picture, so that the primary cause was twice missed.

For cases in which the secondary superimposed factor is a hernia Broca, Schmidt, and Clairmont have proposed the term *pseudo-incarceration*. In these cases the hernia, present for years, becomes suddenly incarcerated as the result of the accumulation of contents due to stasis and the subsequent peristalsis and anti-peristalsis caused by an acute internal intestinal obstruction distal to the hernia. This primary cause may be a dynamic one, as in a case of peritonitis with paralysis of the intestines. Generally we encounter a mechanical obstruction (obturation). At the beginning of this acute illness the vascular disturbances are not conspicuous. An impacted fecal mass, a huge gall-stone, a foreign body, a pedunculated growth arising from the intestinal wall (an invagination), or an encircling new growth is found. In a second series of cases in which a strangulation is the primary cause of a combination ileus the vascular symptoms are predominant; in this type the clinical picture is more alarming. A band, a diverticulum, or a twisted loop of intestine may cause stasis in a hernia situated oral to this point. A second hernia (internal) of the abdominal wall or through an abnormal opening in the mesentery or the omentum may cause a strangulation. The efferent part of the whole loop in a hernia of long standing may become twisted (volvulus).

In all cases of combination ileus this primary factor becomes evident rather slowly, so that most of the clinical features of an obstruction are

concentrated on the additional, second factor (hernia) situated oral to the primary one. Any strangulation (band, volvulus) can form the secondary incident, which so often is the only one seen at the time of the first operation. Necrosis and perforation of the most damaged area of the intestine occur in the more acute cases, if the operation does not remove this obstruction. The simultaneous occurrence of a volvulus with a strangulation of a long-standing external hernia formed the subject of special papers by Knaggs and Miller. In an exhaustive article, Finsterer modified the classification previously put forth by Clairmont. Recently Block reviewed the literature of this interesting symptom-complex.

*Clinical Picture.*—In a first series of cases there is a rupture of long standing in the abdominal wall, with or without the wearing of a truss for a long period of time. In all these cases the hernial ring is quite large; in a ventral hernia the sac is often multilocular—found generally in obese persons. The onset of intestinal obstruction is sudden, with projectile vomiting, becoming feculent within a short time (two or three days); distended abdomen, which is painful all over, especially around the rupture. The hernia shows the clinical signs of incarceration; the sac is tightly filled with content, very tender on palpation, irreducible. In more advanced cases fluid can be detected in the flanks. With the diagnosis of incarcerated hernia the operation is started. In many cases recorded in the literature the surgeon, in seeking an explanation of the clinical symptoms, is apparently satisfied with the examination of the hernial content, of the afferent and efferent loops and the adjacent mesentery. A radical operation for hernia is performed. The persistent vomiting, the absence of flatus and bowel movement, together with increasing signs of peritonitis make a second exploratory laparotomy advisable. On thorough reexamination of the abdominal viscera the primary cause of the ileus is found either in the form of an obturation (a gall-stone, coprolith, foreign body, a slowly growing benign or malignant tumor), or as a strangulation of a loop of intestine by a band, a volvulus, or an internal incarceration. This primary cause almost always lies distal to the secondary, superimposed one. In a case of volvulus the external, apparently incarcerated hernia might be situated oral to the distal loop, or form a part of it (Miller). In the presence of two hernias the second (distal) one is generally small (Clairmont). An abnormal opening in the omentum or the mesentery, or a band (Meckel's diverticulum) may be the cause of strangulation.

*Case Report.*—In a personal experience, a woman sixty-seven years old was sent to the hospital with the diagnosis of acute intestinal obstruction. For three days the typical clinical picture was present. No gas or stool was passed for three days before her admission to the hospital. Repeated enemas were ineffective. The patient was very stout, with a diffusely distended abdomen. A huge, tense para-umbilical hernia was present, very tender on pressure; and this point was the seat of the most intense pains. The obesity of the patient made an examination of the abdomen very difficult. With the diagnosis of incarcerated para-umbilical hernia the laparotomy was begun. Several distended

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coils of small intestine were found to be fixed to the internal wall of the hernial sac, but they did not show any evidence of vascular disturbances (pseudo-incarceration, Clairmont). Further examination of the abdomen was found to be necessary and the incision was enlarged. A huge gall-stone was discovered, impacted in the lower ileum. This stone was removed by enterotomy and the hernia repaired. The patient made an uneventful recovery.

The gradual dilatation of the intestine oral to the obstruction caused a gradual enlargement of the loops fixed in the ventral hernia, with consequent occurrence of more and more pronounced symptoms of incarceration at the point of rupture.

Following herniotomy in any case of incarcerated hernia, a thorough examination of the ringmarks on the gut, and of the afferent and efferent loops of intestine, together with the adjacent mesentery, may give valuable information as to the real causative factor of the obstruction, and as to whether further exploration is necessary. Thus, in a case published by Clairmont, a blue intestinal loop was pulled through the ring into the wound, proving that a circulatory disturbance was present within the abdomen and not only at the hernial orifice. A strangulation of a large convolution of small intestine in a tag of omentum fixed inside the internal ring of the hernia was the primary cause. In one of Miller's cases, when the afferent loop was inspected after the incision of the strangulating hernial ring, it was found to be bluish. A volvulus of  $360^{\circ}$  inside the abdomen had caused the secondary hernial incarceration. Miller quotes a case of huge inguinal hernia extending down to the knee, in which a volvulus inside the sac was superimposed on a second one in the abdominal cavity.

In any operation for incarcerated hernia, when the vascular disturbances in the incarcerating area do not correspond with the severity of the clinical picture, or when more marked changes point to an obstruction inside the incarcerating ring (size of loops, coloration of gut and mesentery), another (primary) cause should be suspected. Further thorough examination of the intestines in the direction of the rectum is then strictly indicated.

In this first, most common type of combination ileus, we have a cause of obstruction, externally visible (hernia), predominating in the clinical picture, associated with an internal cause, which is discovered only at the time of operation (laparotomy). The inconsistency in the findings of the pseudo-incarcerated hernia is an indication for further exploration inside the abdomen. It may be, that following the repair of the hernia the symptoms of ileus do not subside; under these circumstances a second operation is urgent, for the changes within the hernial sac are less pronounced, when there is early surgical interference. The longer operation is delayed, the greater are the vascular disturbances in the second, superimposed obstruction—the incarcerated external hernia.

In a second group of cases of combination ileus no externally visible cause of obstruction can be seen. The abdomen is distended, tender all over, with perhaps loops of intestine showing increased peristalsis. Vomiting is constant

and is accompanied by hiccough and nausea. The liver lies higher than usual; its area of dullness is diminished. In cases of longer standing the signs of peritonitis are predominant, so that the cause of this peritonitis is only recognized at the time of operation. This is well illustrated in a second personal observation.

*Case Report.*—P. W., white man, thirty-three years old, was admitted to the hospital on June 12, 1916, with acute peritonitis. Family history, unimportant. Past history, always in good health up to the present illness. Patient has had a left inguinal hernia since he was twelve years old, on account of which he was exempted from military service. Present illness: June 10, 1916, patient was suddenly seized with intense pains in the abdomen, which lasted for a short time. They gradually decreased in intensity, with exacerbations at intervals of some hours. He had several attacks of vomiting. Next morning (June 11th) the pains and vomiting still persisted. A doctor was summoned, who made a diagnosis of acute gastro-enteritis. He ordered rest in bed with local application of hot compresses, to be changed very frequently. On June 12th patient localized the pains in the region of the bladder and complained that he was troubled with a desire to urinate frequently. He passed water at short intervals. No vomiting, but there was eructation. Later the doctor remembered to have felt a slight resistance on the left side just above Poupart's ligament next to the bladder. Catheterization performed by the family physician revealed an empty bladder. There was no flatulence or bowel movement for two days. Last defecation was one hour before the onset of the present illness.

*General Examination.*—Temperature,  $38.3^{\circ}$  C.; pulse 110. Patient was lying in a passive position in bed; face flushed, conjunctivæ injected, no jaundice of the scleræ; tongue, white, coated, dry, no enlarged tonsils; neck normal. Examination of the chest was negative; urine, no albumen, no sugar.

*Local Examination.*—Abdomen distended in the lower half, flat in the upper half, with muscular rigidity all over, more pronounced in the lower part. On percussion there was tympanitic sound everywhere except in the flanks and above the symphysis and Poupart's ligament. The liver dullness was not increased; the lower border lay above the costal margin. In the left scrotal sac was an irregularly shaped mass the size of a lead pencil, running with the cord to the external inguinal ring, and passing into the inguinal canal. It could not be reduced; it was not tender on pressure; no change was noticed when patient coughed. Rectal examination was negative.

*Diagnosis.*—Appendicitis, acute; peritonitis, circumscribed; left inguinal hernia, indirect, irreducible.

*Operation.*—Ether. A McBurney incision was made. When the abdominal cavity was opened a bluish, distended intestine was seen. Blood-tinged fluid was present. This was indicative of intestinal obstruction. The incision was then closed temporarily. A midline incision was made, large enough to give a good exposure. The following condition, shown in the accompanying Fig. 1, was found: A loop of small intestine was strangulated in a slit of the greater omentum, which extended down into the left inguinal canal. With its medial border, this tag of omentum was fixed inside the left internal inguinal ring. The afferent loop of intestine was distended, the efferent loop collapsed distal to the incarceration. The loop was bluish, the mesentery also cyanotic and œdematous. In order to liberate the intestinal loop the omentum was cut on one side after clamps had been applied on each side. But a portion of this 40 cm. long loop was caught within a properitoneal hernia on the left inguinal side. The

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distended loop produced a protrusion of the peritoneum into the abdominal cavity (Fig. 1). As an incarceration was present a reduction was impossible. Following the herniotomy this loop became free. There was a deep impression in the gut at the point of strangulation, and the serosa was dull. The peristaltic waves did not pass over this area. The whole loop was wrapped up in hot saline compresses. The greater omentum was followed to the left internal inguinal ring, where a medial part was found to be adherent to the anterior abdominal wall. This was cut off. The lateral portion extended down into

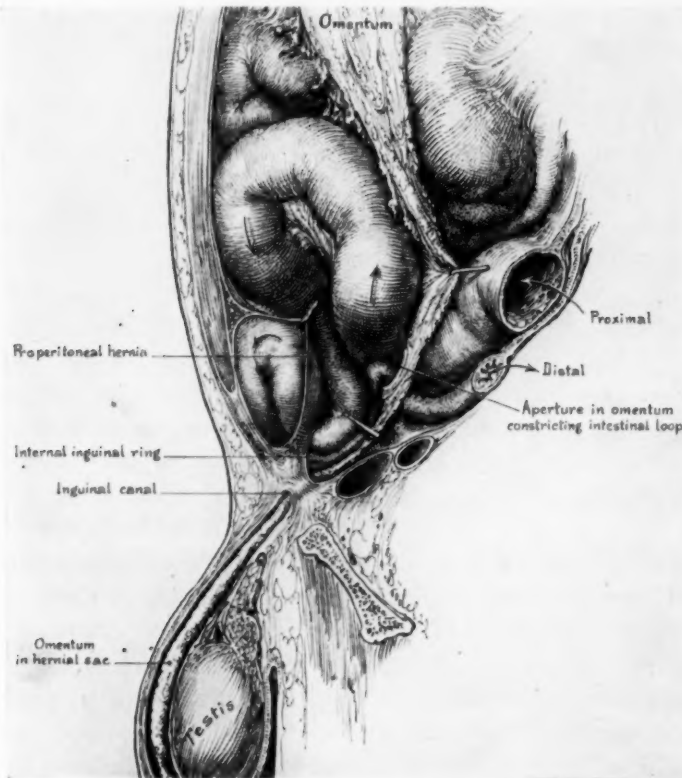


FIG. 1.—Showing the protrusion into the abdominal cavity, caused by the underlying distended loop of intestine.

an inguinal hernia. By using considerable force it was liberated. In order to shorten the operation the opening in the internal ring was closed from the inside without removal of the sac. The loop remained blue, and there was no evidence of peristalsis. It was decided, that resection of the whole loop was necessary, and a side-to-side anastomosis was performed followed by toilet of the abdominal cavity with removal of all bloody fluid. Closure of the abdominal incisions in four rows and bandage completed the procedure.

Patient stood the operation well.

*Post-operative Course.*—Patient made an uneventful recovery and was discharged twenty-six days after the operation without any abdominal discomfort. One year later patient was seen in perfect health.

Schnitzler reported an analogous case with the coincidence of a long-standing incarcerated right femoral hernia in a woman sixty-eight years old,



in which at the time of the first operation only the incarceration of the hernia was relieved. The persistent symptoms of ileus necessitated a second laparotomy. A loop, partly incarcerated before the first operation in the hernia, was found constricted in an opening of the greater omentum. This case, although belonging to our first group, is more instructive when presented together with our personal observation of the second group.

In our second personal case the slit in the greater omentum was large enough to allow the passage of a normal distended small intestinal loop. This opening in the omentum may be either a congenital one as present also in the mesentery, or the end-result of a trauma following a sudden fall, with injury (tearing) of the omentum at the site of the slit. This mechanical agent may act either from the outside through the abdominal wall, or it may be the result of a sudden stroke of a filled intestinal loop against the omentum, attached on one side to the stomach, on the other to the internal inguinal ring. Even without this special predisposing factor formation of an opening may occur. The properitoneal hernia was probably present for a long time. Generally it is accompanied, as in our case, by a congenital inguinal hernia (Krönlein). This secondary sacculation is gradually formed by repeated reposition en bloc of an inguinal hernia. The constant pushing of the abdominal content (omentum) within the inguinal canal against a truss may form an additional factor. In our case the patient asserted, that on lifting or straining the left hernia became larger. For a long time he wore a truss. In our case, as in Schnitzler's, the opening in the greater omentum was not in itself responsible for the occlusion. The occlusion resulted from a part of the same loop of small intestine being caught in the properitoneal sacculation (in Schnitzler's observation: femoral), this factor acting simultaneously with the kinking of this loop in the slit of the omentum. The contents, accumulating in the afferent loop, first caused the incarceration of the properitoneal hernia. The same vicious circle distended the afferent loop in the opening of the omentum more and more and constricted the efferent loop and mesentery; the combination ileus became a fact. In Schnitzler's case Clairmont thinks that the internal strangulation in the omental slit was the primary factor, and the incarceration of the hernia, resulting from an increased stasis of the bowel movement, with the consequent increase in peristalsis and antiperistalsis making the hernia irreducible, a secondary one. Finsterer assumes that the incarceration of the hernia was the primary factor, with a secondary internal strangulation. Undoubtedly we are confronted in these two cases with the alternating ill effects of two causes of the hernia, which bring about a relative fixation of the loop beyond the opening in the omentum. Increased peristalsis and antiperistalsis are powerless to counteract this condition. In this way is caused the incarceration of the primarily irreducible hernia simultaneously with an internal strangulation of the whole loop of intestine within the slit of the omentum.



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In our second group of combination ileus both causes escape our physical examination previous to operation. The clinical symptoms point to an intestinal occlusion. Close examination of the size, colorations, and condition of the gut in different regions of the abdomen at the time of the exploratory laparotomy clears up the underlying pathological condition.

*Diagnosis.*—In the first group mentioned, where we encounter a combination of an external rupture in the abdominal wall, and signs of incarceration (pseudo-incarceration) associated with a secondary occlusion within the abdominal cavity, the true diagnosis can only be made at the time of operation by a thorough examination of the intestine beyond the ring of probable incarceration combined with painstaking but thoughtful examination of the size and vascular conditions (cyanosis) of one or both loops inside the hernial ring. In cases which come under observation early, the severity of the symptoms might not be explained on the basis of the long-standing, large hernia with vague signs of incarceration, so that a second factor of obstruction has to be sought for. In cases seen when the clinical symptoms are more advanced and the signs of peritonitis very pronounced, it is rather difficult to make such a differentiation even in our first group. This is particularly true for men accustomed to explain the symptoms by one and not by several causes. In any case of incarcerated hernia a thorough examination is indicated of the afferent and efferent loops (size and coloration), together with the changes at the point of incarceration and the adjacent mesentery. A blue, dilated afferent loop with or without an efferent loop similarly affected points to a combination ileus, the primary cause being removed only by an exploratory laparotomy.

In our second group of cases the diagnosis of combination ileus can only be made at the time of operation by careful examination of the size and vascular condition of the intestine adjacent to the site of the detected obstruction and by following them thence in both directions (orally and distally). As demonstrated in Hochenegg's case, it is often very difficult to exclude a second obstruction, if at the exploratory laparotomy an inspection and palpation of the whole intestinal tract is omitted.

Since in every case of intestinal obstruction the accumulation of gas in the intestine is different, varying with the location of the obstruction (high, low), Kloiber advises an X-ray examination (plate) of the abdomen. From a series of such pictures obtained from different cases of intestinal obstruction verified subsequently by laparotomy, Kloiber set forth certain laws about the location of the greatest amount of gas in the presence of the obstruction at different levels of the intestinal tract. Due to the fact, that this method is very unreliable and that in all these cases immediate operation is urgent, this examination means a loss of time, with greater, avoidable shock to the patient, and does not shorten in any way the operation after one source of obstruction has been exposed. It is not justifiable to postpone operation for a diagnostic procedure which does not add anything to a thorough local examination.

*Therapy.*—Hernio-laparotomy for the cases of the first group, laparotomy for cases of the second group is the therapy of choice. In a previous article on gall-stone ileus I advised laparotomy under splanchnic- and block-infiltration anæsthesia of the abdominal wall as the best technic. This holds true for a man experienced in the technic of this form of anæsthesia. A much better recovery takes place following this operation in these cases, generally in poor condition. For the average surgeon general anæsthesia has to be employed. The most suitable method of procedure in each case depends on the pathology of the lesion, and on the vascular changes which have taken place in the tissue involved in the obstruction or strangulation from the onset up to the exposure at the operation.

*Prognosis.*—The earlier the case comes to operation, the less are the pathological changes in the intestine at the site of occlusion, the less also is the alteration of the general condition (dehydration, toxæmia). By using local anæsthesia in form of a combined splanchnic abdominal wall local anæsthesia the chances for a quick and uneventful recovery are much improved. Clairmont, in his very exhaustive statistics, found a mortality of 70 per cent. (1909). This was particularly due to the fact that an erroneous etiology was the guidance at the first operation in many cases reported in the literature. The real cause persisted and necessitated a second surgical interference after hours, and even days. In this way the final cure was postponed. In the meantime the patient lost more of his vital resistance.

*Summary.*—Combination ileus is a clinical entity, which may be suspected in any case of incarcerated hernia (pseudo-incarceration), where the history of the present illness, together with the findings of the local examination, show a marked discrepancy with a clinical picture of a complete acute intestinal occlusion of longer standing; and particularly where an unusual picture is discovered during the operation following a herniotomy at the ring of incarceration, the size and vascular condition of the afferent and efferent loops of intestine and adjacent mesentery.

Another primary cause of obstruction inside the abdomen may be suspected. Vascular disturbances, dilatation of the afferent and efferent loops are points of significance in these conditions. A laparotomy with thorough examination of the gut orally and aborally will expose the primary factor in the occlusion. This is generally a mechanical occlusion, either an obturation (gall-stone, coprolith, new growth), or a strangulation (hernia, band, volvulus, diverticulum). In cases of peritonitis with paralysis of the intestines we have to consider a dynamic ileus as primary factor.

In a second group of cases both causes are located inside the abdomen. With the presumptive diagnosis of acute intestinal obstruction, the laparotomy is indicated. After having removed one cause of obstruction a thorough and thoughtful examination and palpation has to be made to exclude the presence of a second, hidden, primary cause or a second superimposed cause of acute occlusion. Every case of combination ileus needs prompt surgical

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interference. The earlier the operation is performed the better is the prognosis. The great mortality in these cases is due to the fact that at the time of the first operation (herniotomy, laparotomy) only one factor in the obstruction is removed and a second operation, with the patient in much weaker condition, is necessitated by the persistence of the symptoms of an acute intestinal obstruction. In observing the directions given above, this danger should be greatly diminished.

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**TRANSPPOSITION OF THE RECTUS MUSCLE AND THE  
UTILIZATION OF THE EXTERNAL OBLIQUE  
APONEUROSIS IN THE RADICAL CURE  
OF INGUINAL HERNIA**

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At this date, 1922, some thirty-five years after the publication of Bassini's first communication, a continued discussion of the subject of the radical cure of inguinal hernia is sufficient evidence that operative technic is ever changing to meet the faults or deficiencies of earlier procedures. Our surgical art is ever advancing and the more rapidly with a better recording and following

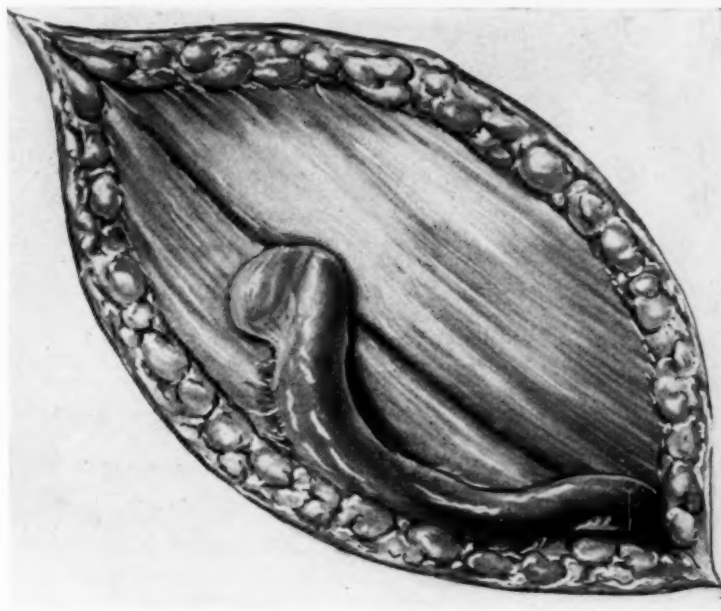


FIG. 1.—Appearance of the three small recurrences along the cord through the internal ring.

of operative cases and a freer interchange of ideas. The literature upon inguinal hernia is not voluminous. The operation advocated by Bassini in 1887 satisfied operators for nearly twenty years, as cases were rarely followed and the number of recurrences was entirely unappreciated.

The Bassini operation, founded upon correct, sound, anatomical and physiological principles was sufficient to cure the majority of cases of inguinal hernia and still is. There is, however, a goodly percentage of cases where because of the patient's anatomical deficiencies of musculature it is insufficient alone to do so. This was appreciated by a few at the close of the last century. Bloodgood, Andrews, Coley, Blake, and later Judd and Downes, published modifications and additions.



In 1913,<sup>1</sup> I traced the history from Bassinis' publication up to that year and again spoke for the transposition of the rectus muscle and again in 1918,<sup>2</sup> during the war, made a further plea to fit the operation to the case and not force every case of hernia to fit a classic operation however good that might be for the average case. In 1920<sup>3</sup> Huguët, Stettin and myself again advocated additional use of the external oblique aponeurosis as one more layer to reinforce the old classic procedure. This could be used with or without a transposition of the rectus as well, thus giving three layers of

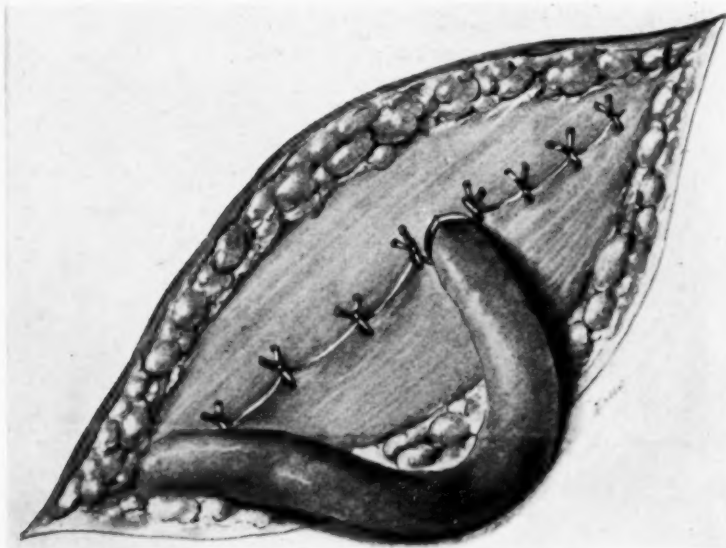


FIG. 2.—Old method which appeared to leave a weakness at emergence of the cord.

tissue in those bad direct herniæ as well as in the simpler indirect variety where the oblique muscles were weak and inadequate for a strong repair. The anatomical resources of this region are fortunately considerable and are of vast importance when well used.

The late war greatly stimulated interest in this class of case, enormously increased the number of operated cases, and made it of paramount importance that the men operated should have the greatest fortification possible of this inguinal region and the greatest care used in selecting the type of operation in each case. From the additional experience of the last decade I believe that the problem of the cure of direct hernia is solved to within 3 or 4 per cent. in those cases whose physical condition will permit of operation. The purpose of this paper is to give the results of the cases of rectus transposition and aponeurotic overlap done the last three years which have been followed,

<sup>1</sup> ANNALS OF SURGERY, vol. lviii, 1913.

<sup>2</sup> ANNALS OF SURGERY, vol. lxxvii, 1918.

<sup>3</sup> ANNALS OF SURGERY, vol. lxxi, 1920.



### TRANSPPOSITION OF RECTUS MUSCLE IN HERNIOTOMY

as well as to call attention to a source of weakness in the procedure of overlapping the aponeurosis that has appeared in three cases.

Utilizing in all direct hernias the imbrication or overlapping of the external oblique aponeurosis and nearly always with a transposition of the rectus as well, there has been no recurrence as a direct hernia in these cases during the last three years.

The imbrication or overlap of the oblique aponeurosis has been used practically as a routine addition to the hernia operation for the last three

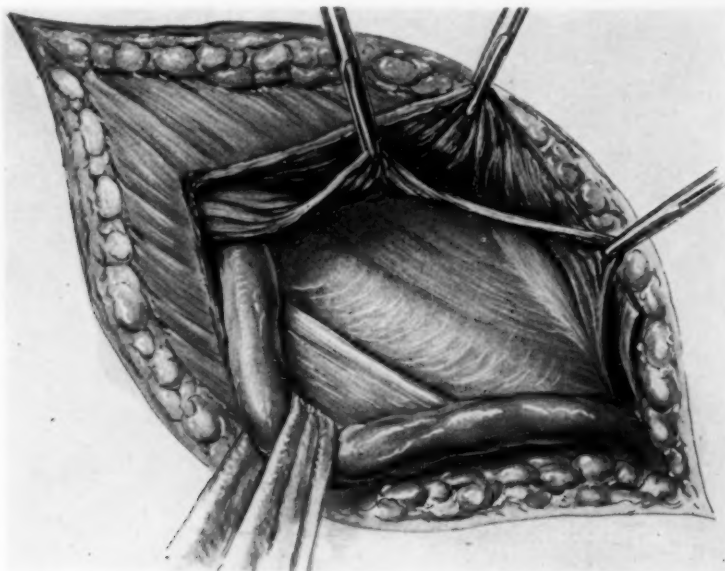


FIG. 3.—Exposure of rectus by wide retraction of oblique muscles.

years in indirect as well as direct cases, usually excepting hernias in women and children. The last two years I have modified the method with advantage, having had three small indirect recurrences at the site of the internal ring coming out along the cord (Fig. 1). They could be repaired easily under local anæsthesia and have not recurred to date. The illustrations show the character of this recurrence and the present modification. Even as such they were not a great price to pay for the cure of large direct hernias. It was of great interest to note in those reoperated cases that the rectus muscle was found where it had been sutured. It had not separated from Poupart's ligament.

To find material for the protection of the frequently weak inner half of Hesselbach's triangle and through which direct herniæ come is not very difficult, but we should not lose sight of the internal ring with its weakness at the exit of the cord. It apparently is not alone necessary to suture muscle as closely about the cord as possible without obstructing its circulation, but one must oppose another structure over this exit of the cord to act as additional barrier here and to seal the opening by agglutination. The aponeurotic

overlap recommended in 1920 was achieved by slitting both halves of the external oblique aponeurosis opposite the cord (Fig. 2) to allow free overlap. This method most satisfactorily strengthened the overlap and proved most satisfactory in curing direct hernias and fortifying tissues of deficient musculature in indirect hernias, but it left the internal ring too unprotected. The method of bringing the cord up and lapping the lower or outer half over the opening seems to have overcome this and allowed a maximum of protec-

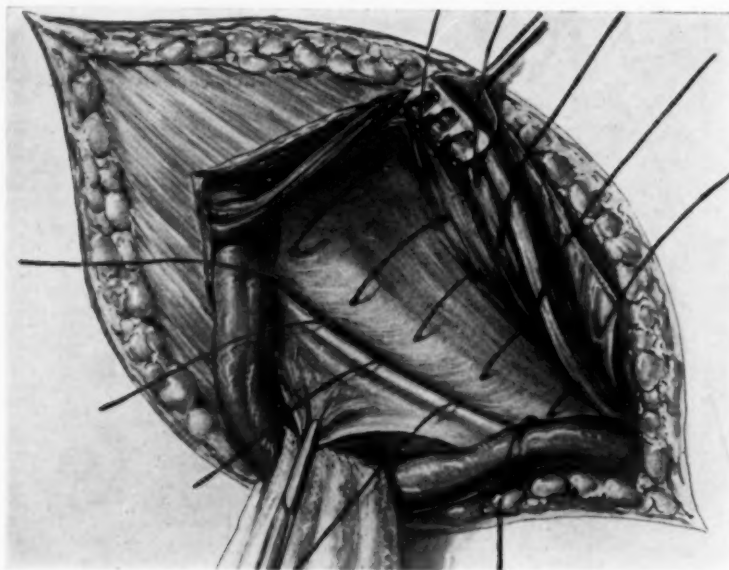


FIG. 4.—Sutures passed well through the reflected or shelving edge of Poupart's ligament. Rectus sheath widely opened.

tive strength for both areas. There have been no further recurrences since doing this.

It would seem that in every operation for the cure of inguinal hernia it is of the greatest importance that the cord be transplanted and not brought out under the muscle or aponeurosis at the lower end of the wound and that the inguinal canal be completely obliterated to the pubic spine.

The utmost agglutination and broadest coaptation of muscle and aponeurosis to Poupart's ligament and its shelving reflection and the muscles and aponeurosis to each other is essential in every case and especially in this inner half when we find deficient oblique muscle and weak transversalis fascia. The technic of rectus transposition is not difficult, yet from published descriptions where the sheath has been opened but a short distance and two or three, or possibly four, sutures were used to bring the muscle to Poupart's ligament, it can be understood why so many men feel that the rectus cannot be made to stay in this relation. It has seemed to me that the internal oblique and transversalis muscles must be retracted well upward and inward and the thin sheath of the rectus (Fig. 3) opened from behind for fully five inches.

## TRANSPPOSITION OF RECTUS MUSCLE IN HERNIOTOMY

The muscle must be separated from its sheath anteriorly and posteriorly by the finger throughout its whole lower extent. Under proper anæsthesia it is amazing how easily it is brought down without tension and sutured by five stitches to the deepest shelving part of Poupart's ligament, including a small part of that structure itself (Fig. 4). It is thus almost below the ligament proper. The lowest suture is taken at the spine, closing completely the apex of Hesselbachs' triangle, and the uppermost suture taken at the internal ring close to the cord exit. I do not believe that in any other way will the muscle stay as thoroughly in place. The alignment of its fibres is not so greatly changed (Fig. 5) and the newer attachments to the next layer superimposed, the

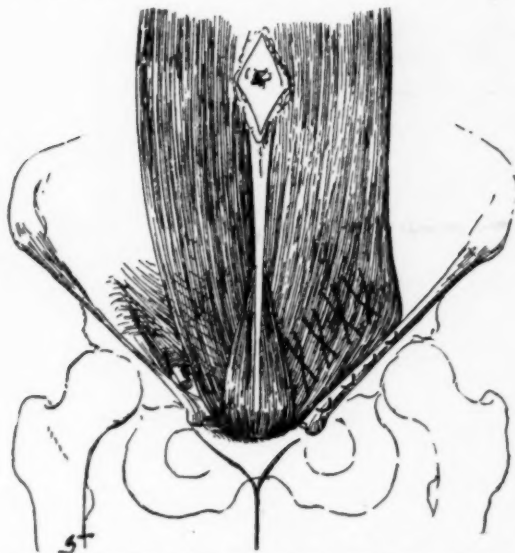


FIG. 5.—Deviation of fibres of rectus (after Bloodgood), after suture to Poupart's ligament.

oblique muscle and transversalis, materially help to maintain it in its new position. This muscular layer (the Bassini procedure) is sutured to Poupart's proper (Fig. 6). There is one more suture that I have used to help maintain the rectus and this is taken through the obliques, above and internal to the cord to the rectus, making a total of six interrupted stitches. The strain is thus distributed and equalized. The aponeurotic overlap is then done, the internal half of the external oblique aponeurosis sutured to the upper part of Poupart's ligament and the outer half lapped over

this, leaving the cord superficially beneath skin and adipose tissue where it seems to cause no discomfort (Fig. 7). This overlap of the halves of the divided aponeurosis of the external oblique muscle adds a very real strength in the amalgamation of the various layers which we are able to interpose between the peritoneum and weak transversalis fascia and the outer world. As a last precaution these patients have their knees well elevated before they return to consciousness and the head and trunk moderately flexed as well. This position for the first week or ten days is of considerable importance in relaxing muscle tension. The repair in these more serious cases done in this way is not difficult and I believe at present can only be done effectively in this way and give this procedure the chance for more general favor which I am convinced is its due.

Differences in reparative power, inequalities in even the best suture material and inequalities of its absorptive time by individuals as well as the patient's care of himself after operation, all play a part in hernial recurrences where clean primary union has been secured. The inclusion of the weak

cremaster muscle in the repair of inguinal herniations has, I believe, contributed to recurrence, particularly in the direct area. The insufficient cleaning of Poupart's ligament of connective tissue that may prevent intimate contact probably is of etiological importance. Adequate relaxation in bed after operations of this sort for eighteen days is desirable.

The various procedures utilizing the rectus muscle and the aponeurosis of the external oblique muscle have a definite usefulness in a number of cases of indirect as well as direct hernia, with muscular deficiencies where the operation

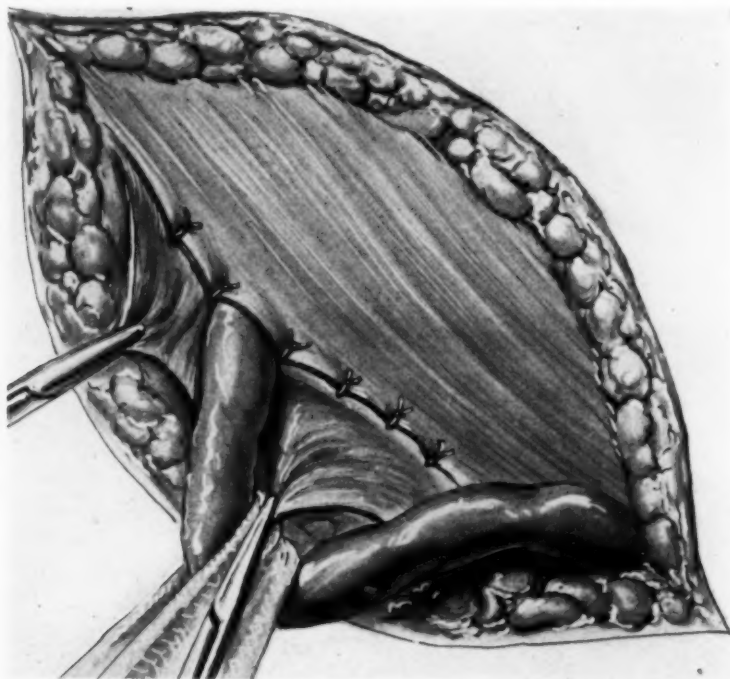


FIG. 6.—Inner half of external oblique aponeurosis sutured to Poupart's over rectus and over the internal oblique and transversalis.

is made to fit the condition and not the condition made to fit a fixed operative procedure.

Of the cases of inguinal hernia which have come to me for operation the last four years and a half, a rectus transposition was done eighty-five times, an overlap of the external oblique aponeurosis ninety-seven times, a combined rectus transposition and aponeurotic overlap in forty-eight and the Bassini repair with aponeurotic overlap in forty-nine. All other cases were operated using the straight Bassini procedure.

During the years 1917 and 1918, the majority of hernia cases were in recruits or service men very few of whom could be followed. I believe that notwithstanding the operative care and selection of a strong type of repair the percentage of recurrence in these cases would be found above normal,

## TRANSPOSITION OF RECTUS MUSCLE IN HERNIOTOMY

as the men were enthusiastic, difficult to restrain and took poor post-operative care of themselves. In the last four years eighty-seven of these modified repairs were traced and observed in the follow-up clinic. Of twenty-two direct hernias, operated with rectus transposition and overlap of aponeurosis, none have recurred. Two recurrences followed in cases of indirect hernia operated by Bassini muscle repair with aponeurotic overlap. Both cases had extensive post-operative wound infection. As mentioned above, in three direct hernias that have remained cured of their large direct ruptures, there appeared within the first year a small protrusion along the cord (Fig. 1)

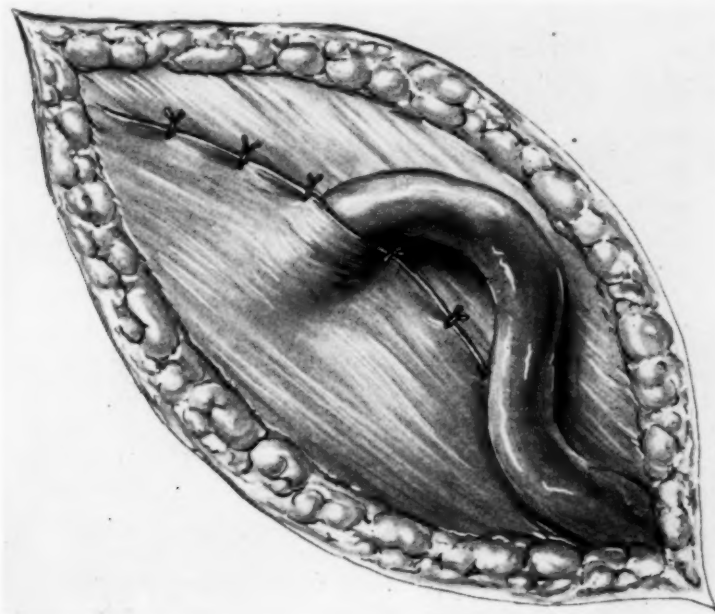


FIG. 7.—Outer half of the external oblique aponeurosis lapped over the inner and exit of cord, closing the area of emergence opposite the internal ring more completely.

coming out through the internal ring. These were easily repaired and at reoperation it could be clearly demonstrated that the rectus muscle had not separated from Poupart's ligament. Two of these men were laborers and had resumed heavy work within two weeks after leaving the hospital. It led as mentioned to a change two years ago in the method of imbrication of the external oblique aponeurosis at the exit of the cord opposite the internal ring. Since this time there have been no other recurrences in these cases to date. But fifteen cases were in women and in only three were modifications of the usual procedure done. There have been no recurrences in any. Only twelve cases were in children and there was but one modification which has remained well over two years. Two were not seen and the rest have remained well.



## ANTERIOR DISLOCATION AT THE ELBOW JOINT

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IN view of the comparative frequency of posterior dislocations of the elbow it is rather remarkable that anterior dislocations of that joint should be among the rarest of injuries.

How commonly elbow dislocations occur may be judged from Krönlein's series of 400 recent traumatic dislocations, where 109, or 27.2 per cent., involved the elbow; and yet if in all the cases of anterior dislocation of this



FIG. 1.—X-ray showing anterior dislocation of elbow, with detachment of internal epicondyle.

joint thus far reported we exclude those associated with fracture of the olecranon—which, by common consent, should not be regarded primarily as dislocations—the total number does not exceed twenty.

The injury is mentioned by Hippocrates as the most painful of all dislocations, and as fatal in a few days, but no authentic case seems to have been described until within the past century. In fact, Sir Astley Cooper (1768–1841) denied the possibility of its occurrence.

Streubel in 1850 collected a few cases and discussed the mechanics of their production, describing his attempts to reproduce the deformity on the cadaver.



## ANTERIOR DISLOCATION AT THE ELBOW JOINT

The most complete review of this injury is that of Stimson, who records a list of cases observed up to 1912. He accepts twenty-four as authentic, of which seven were associated with fracture of the olecranon and hence hardly to be included. Of these all but two were reported prior to 1900.

I have been able to find but three subsequent cases in the literature; one by Von Walzel, one by Winslow, and a third by Sir Robert Jones, the latter case complicated by olecranon fracture.

These, together with the following case from the fracture clinic of the Montreal General Hospital, bring the number, excluding the eight cases with detachment of the olecranon, to a total of twenty.

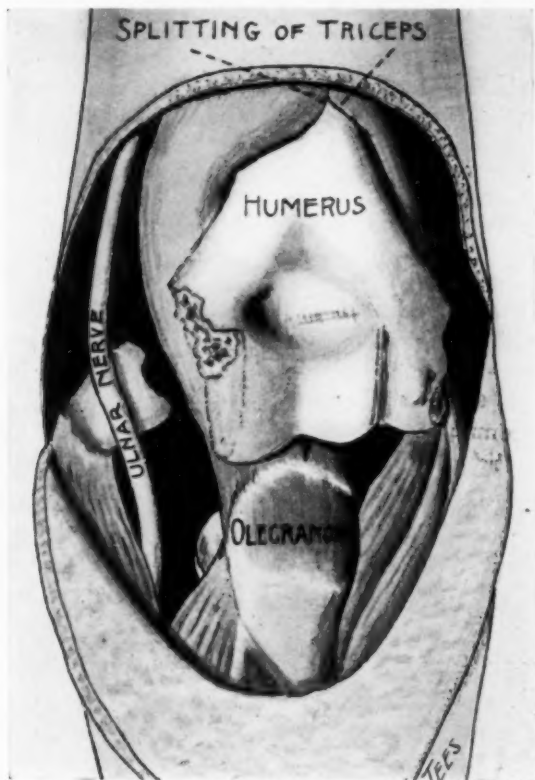


FIG. 2.—Right elbow from behind. Anterior dislocation of elbow with button-holing of lower end of humerus through triceps tendon.

*Report of Case.*—C. G., aged twelve, No. 5189, 1920, was admitted to the Montreal General Hospital on November 16, 1920. While in a laundry on the day of admission, his curiosity led him to try the effect of feeding his right hand between the revolving rollers of a wringing machine, with the result that his arm was securely caught. As he attempted to extricate himself from the machine, his elbow was squeezed by the rollers, and the olecranon forced downwards and forwards over the end of the humerus, bringing about a complete anterior dislocation of both radius and ulna.

On admission the arm was swollen and ecchymosed for a hand's breadth

above and below the elbow. The lower end of the humerus, especially the external condyle, could be palpated, but there was a complete absence of anything to correspond with olecranon, and the internal condyle was not palpable. On measurement the forearm was appreciably lengthened. The elbow was most comfortable when held at an angle of 135 degrees. Movements at the joint were flail-like; quite free in flexion and to the sides, but limited to 150 degrees in extension.

The skiagram, by Dr. W. A. Wilkins (Fig. 1), revealed a complete forward dislocation of both radius and ulna, with a detachment of the internal epicondyle.

One was led to expect from the experience of various authors that reduction would be a simple matter, but a protracted attempt under anaesthesia was completely unsuccessful.

On November 26th, open reduction revealed the reasons for the failure. A horseshoe flap was turned down, uncovering the bare lower end of the humerus, which was projecting backwards through a button-hole opening in the triceps tendon (Fig. 2). The tendon had been split longitudinally; the main portion, having been carried between the humerus and the detached internal epicondyle, was lying in front of the trochlear surface of the humerus, the remainder passing forward around the outer side of the bone. The ligaments had been completely torn away. The ulnar nerve had been displaced inwards with the detached epicondyle: it was dissected out with care and found to be uninjured. Even with the parts completely exposed, reduction was difficult and could never have been accomplished by manipulation alone.

After reduction the loose fragment was sutured in position, the wound closed, and the arm fixed at right angles in plaster. The wound healed by primary union. No manipulation was undertaken for two weeks, and then most gently and sparingly. In this we followed the teaching of Mennell and others that the elbow-joint must be excepted from the rule calling for early mobilization after joint injuries. Nevertheless a lot of callus formed about the lower end of the humerus and when the patient left the hospital on February 11, 1921, movement in the joint was considerably limited, ranging from 80 to 125 degrees. Efforts to have him report his subsequent progress have been unavailing.

*Comment.*—After scrutiny of a series of X-rays of the elbow-joint in children, such as have been published in a recent article of Cohn on the developing elbow, one is prepared, from the apparent lack of security in attachment of the main lower epiphysis of the humerus, to expect frequent epiphyseal separation as a result of injury; but the relative insignificance of the olecranon is equally striking, which, it might be thought, would render anterior dislocations of common occurrence. Yet but three of thirteen cases of Stimson's series in which the age is stated occurred in children under fourteen years of age.

The explanation of this extreme rarity seems to lie in the strength of the ligaments rather than in the contour of the bones. The ligaments, even in children, must be sufficiently strong to resist a dislocating force from above and behind (such as occurs in falls on the flexed elbow), and hence, as a result of this form of trauma, there is ordinarily produced not a dislocation but a separated epiphysis or a supracondylar fracture.

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## CARDIOSPASM IN THE AGED

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CARDIOSPASM is as a rule most frequently encountered in youth or middle age. When, however, elderly people begin to show symptoms of interference with deglutition, apparently due to some narrowing of the œsophagus, one is more inclined to consider the condition carcinomatous and without making an exhaustive examination allow these patients to gradually starve, appreciating the fact that radical therapy is of so little effect and that a gastrostomy merely prolongs for a short time a life of suffering.

That this danger of not making a thorough examination is a very pertinent one is illustrated in the recitation of the following two cases:

CASE I.—Single, age sixty-one, male, November 7, 1921. Previous to examination had been seen by several competent physicians by whom a diagnosis of carcinoma œsophagi had been made. His first complaint had begun in May, 1918, when he noticed that on bending forward saliva or some secretion flowed back into his mouth. Two months later it was noted that the food passed into the stomach with difficulty, liquids as well as solids, and was in a large measure regurgitated. This occurred also at night. Intensity of his complaint steadily increased.

On examination it was apparent that there was a large retention in the œsophagus which was cleared only after long-continued lavage. Radiographic examination showed a marked dilatation of the œsophagus, ending at the hiatus œsophagi, where it passed into a fine-lined shadow, resembling in all respects that seen in instances of cardiospasm. There was, however, some little doubt as there was a blurring of the termination of the funnel. An ordinary stomach tube did not pass the cardia, but after a thin soft sound had been carefully passed first, a thick stomach sound was passed easily. Subsequently a Gottstein sound was passed easily and withdrawn after being filled with water, demonstrating that we were not dealing with an organic stricture. Œsophagoscopy demonstrated a greatly dilated œsophagus with marked infolding near the cardia, no evidence of tumor was to be seen, even after the œsophagoscope had been passed through the cardia. Diagnosis was therefore made of cardiospasm. His treatment consisted of feeding through a stomach tube and lavage of the œsophagus. The man rapidly familiarized himself with this technic and was able to carry it out himself without difficulty, gradually taking food by mouth until within a short time he was able to eat with comfort.

On examination, June, 1922, he appeared in perfect health and had since April, taken all of his meals normally, but was careful to have the food in a fine state of division. The œsophagus apparently emptied itself completely. His weight had increased  $3\frac{1}{2}$  kg. Final radiological examination shows a practically perfect recovery of the function of the œsophagus. There remains a moderate degree of dilatation which, however, is greatly reduced.

CASE II.—Female, age sixty-six. Complained of difficulty in swallowing for more than a year of varying degrees, but lately very little food has passed into the stomach and patient has been rapidly failing.

The examination showed practically the same findings as noted in the previous case with, however, the difference that we were not able to pass the cardia with the œsophagoscope and only succeeded in getting into the stomach with the stomach tube after preliminary sounding with a thin malleable sound. Later we were able to dispense with this preliminary sounding. The slow progress of the illness justified our inferences that the case was certainly one of cardiospasm. During the course of her treatment she developed a peritonitis which, however, was not caused by perforation of the œsophagus, and on laparotomy examination of the cardia and stomach did not show the presence of any tumor. It was noted that the intra-abdominal part of the œsophagus was very long, as occurs so frequently in cases of cardiospasm. While the general condition of the patient has improved greatly under this treatment, all evidence being to the effect that we were dealing with cardiospasm. Trial omission of the stomach tube feeding has not as yet been made, and we have not been able to judge of the functional recovery of the œsophagus.

While as stated previously, the greater percentage of instances of cardiospasm have been observed in middle-aged patients, here we find two cases in whom the condition has occurred, one at the age of fifty-eight, and the other at the age of sixty-five, therefore one should be careful not to make a diagnosis of carcinoma of the œsophagus, however probable it may be, merely on account of the age of the patient and allow the patient to suffer unnecessarily from the lack of treatment which will make them entirely comfortable.

The first case shows how completely recovery can be obtained in a case of cardiospasm from stomach tube feeding and the ultimate restoration of the œsophagus obtained, as demonstrated radiologically. This case apparently negates the argument that cardiospasm follows a primary mega-œsophagus as promulgated by Von Hacker and Sencert.

However, this simple treatment is not always so effective as in the case quoted as noted in a previous communication,<sup>1</sup> in which such treatment was entirely ineffectual during two and one-half years, while subsequent operation by Heller led to a very considerable lasting improvement with practically recovery of the case. However, the treatment of lavage of the œsophagus and stomach tube feeding is so simple that this class of case should be given a thorough trial with it first. Operative intervention is naturally of a more serious character and even the dilatation treatment with the Gottstein sound is not without its dangers. Cases in which this has been used have suffered from perforation with subsequent death.<sup>3</sup> Plummer and Porter report seventy-five per cent. of 301 cases relieved by divulsion, obtained by means of a hydrostatic dilator with pressure of thirty feet of water, although in the beginning of this treatment they lost two patients from rupture of the œsophagus. Naturally, if it is impossible to pass the stomach tube through the cardia, the case cannot be treated as the two cited in this article have been, and one may attempt sounding under the circumstances, passing the sounds under guidance of the œsophagoscope, as recommended by Benjamins in Holland and Guisez in France.

## CARDIOSPASM IN THE AGED

In many of these cases in which at the beginning it was impossible to pass the cardia, it has been possible to eventually accomplish this by beginning with a thin pliable bougie with terminal olive bulb, with which one may in many instances succeed in passing the cardia. This should be followed by increasing the graduated sizes after which the stomach tube may frequently pass with ease, which primarily was impossible.

It is our custom, therefore, to only consider operative intervention as the last resort. The usual method employed in Holland is that of Heller, in which a longitudinal incision is made across the narrowed part and deepened as far as the mucosa. We have now employed it in eight cases without mortality. The results are very satisfactory, although subsequent radiologic examination show that a condition of *restitutio ad integrum* has not been effected. It does not appear to make any difference relative to the subsequent findings whether the incision is made on the anterior side and one on the posterior side as Heller<sup>4</sup> did, or one incision only on the anterior side as has been employed by de Bruine, Groeneveldt and myself. Heller points out that he considers it necessary to lengthen the incision particularly downwards, whereas it need only to be carried upwards as far as the beginning of the dilatation.

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TRANSACTIONS  
OF THE  
PHILADELPHIA ACADEMY OF SURGERY

*Stated Meeting Held December 4, 1922*

The President, DR. JOHN H. JOPSON, in the Chair

ACTINOMYCOSIS TREATED WITH COPPER SULPHATE

DR. ROBERT H. IVY presented a female, aged twenty-eight, housewife, whose present trouble began in July, 1922, when she noticed soreness in the left lower molar region. The first and third lower left molars became loose and were extracted between the first and the tenth of July. This was followed by swelling of the tissues overlying the mandible on the left side and finally pus broke through the skin just beneath the left side of the chin.

Patient was first seen August 18, 1922, when there was a sinus discharging pus at the point mentioned. The whole left side of the face was considerably swollen, indurated, and painful, with marked trismus. Patient was admitted to the Polyclinic Hospital, Philadelphia, on August 24, 1922, with a diagnosis of periostitis of left body and ascending ramus of mandible, probably of dental origin. The radiographic examination was negative for any bone lesions. August 25, 1922, under gas-oxygen anaesthesia, an incision was made beneath left angle of mandible, some thick pus obtained near the periosteum, and a rubber drainage tube inserted. Culture from the pus revealed only a staphylococcus. The condition improved for a time, but induration and purplish discoloration of the skin remained. Another focus of suppuration gradually appeared in the region of the left zygomatic arch. September 8, 1922, a small incision above and parallel to the arch was made, thick pus escaping. A Carrel tube was passed down beneath the zygomatic arch and brought out of the old incision at the angle of the jaw. The opening just to the left of the chin had also again opened spontaneously. Smears from the pus showed no microorganisms. Irrigation with Dakin's solution was carried out for about a week with beneficial results, after which the rubber tube was removed. The temperature at no time had been above 101 degrees, and was generally below 100. General condition of the patient was good. September 22, 1922, the swelling and evidence of suppuration having again appeared near the lower openings, smears were carefully made from some small granular flakes in the pus, and branching rods, in some cases with clubbed ends, were found, identified as actinomyces. Repeated attempts at culture of the organisms from the pus, anaërobic and aerobic on various media, failed entirely. Complement fixation of patient's serum was negative, Doctor Kolmer using as antigen a stock culture of actinomyces bovis. Agglutination tests



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with the same culture were also negative. The skin reaction was doubtfully positive. However, since the branched and clubbed rods were repeatedly found in smears made from the sulphur-like granules appearing in the pus, this was considered sufficient for diagnosis and the case was thereafter treated as actinomycosis.

September 27, 1922, following the suggestion of von Baracz (*Zentralbl. für Chir.*, May 6, 1922), under local anaesthesia, 15 c.c. of a 1 per cent. solution of copper sulphate was injected directly into the indurated tissues, particularly the parotid region. This was very painful and produced a marked temporary increase in the swelling, with oedema extending to the left eyelids. The sinuses at the same time were curetted and swabbed with tincture of iodine. This was followed after a few days by a marked increase in the flow of pus and the tissues became softer. The wounds were irrigated daily with 1 per cent. copper sulphate solution and swabbed with tincture of iodine. Ten days after the first injection, under gas-oxygen anaesthesia, 12 c.c. of 1 per cent. copper sulphate solution was injected into the most indurated part which was now about the left angle of the mandible. The inflammatory reaction was not as marked as after the first injection, and subsided more rapidly. On October 1st, internal administration of potassium iodide was also begun, with 5-grain doses three times a day, rapidly increased to a maximum of 30 grains three times a day, which was continued until November 1, when the amount was gradually reduced and finally discontinued.

The patient was discharged from the hospital on October 14, 1922, since which time there has been a gradual subsidence of the swelling. On November 13th, all sinuses had healed, induration was gradually disappearing, and the patient was able to open the mouth much better. There was a slight paresis of some of the muscles of expression about the mouth and eyelids. On November 27th, at the site of one of the old sinuses over the ascending ramus of the mandible, a small area of softening appeared and on opening into it a thin fluid with a few granules was obtained. Actinomyces were found in smears made from the granules. Although this new wound remained free from suppuration after opening, another parenchymatous injection of 5 c.c. of 1 per cent. copper sulphate solution was given on December 1st. While too recent to venture a definite opinion, the favorable influence of previous injections and the small size of the new lesion lead to the hope that a permanent cure will soon follow.

Actinomycosis, in this part of the country, is decidedly rare, or at least is infrequently diagnosed. He believed, however, that these cases are more common than is ordinarily recognized. In the beginning, when it affects the region of the angle of the mandible, the disease cannot be distinguished from an ordinary subacute periostitis of the lower jaw of dental origin. There are soreness and loosening of the teeth, deep-seated swelling, induration and trismus. Later, areas of softening occur, with the appearance of chronic discharging sinuses. Actinomycosis, therefore, should always be

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considered as a possibility in any long-standing case presenting these symptoms. Absolute diagnosis of course rests on the finding of the organism in the sulphur-like granules in the pus. Two years ago a case was seen with almost identical history and symptoms as the one reported here, and was treated for several weeks as an ordinary infection of dental origin, until finally the specific organism was found.

The employment of copper sulphate as a specific in actinomycosis was first suggested by Bevan (*Jour. A. M. A.*, November 11, 1905). He used it internally as a substitute for potassium iodide in doses of from one-fourth to one-half a grain, increasing the dose if necessary to one grain, three times a day, and also employed a 1 per cent. solution for irrigation of the sinuses.

Von Baracz (*Zentralblatt für Chirurgie*, May 6, 1922) reports that in nineteen years he has observed 36 cases of actinomycosis and successfully treated 35 of them by infiltrating the affected tissues with a weak solution of copper sulphate (one-half to one per cent.). From 10 to 40 c.c. of the solution are injected with a hypodermic syringe every ten days to two weeks, two, three or four injections being necessary according to the severity of the case. The injections are combined with opening, curettement and drainage of the lesions and irrigation of sinuses with the copper sulphate solution after swabbing with tincture of iodine. The favorable results in this large series of cases render this method of treatment at least worthy of extensive trial.

### HELIOOTHERAPY FOR TUBERCULOSIS OF BONES AND JOINTS

DR. A. BRUCE GILL, in order to demonstrate the results of this treatment, exhibited the following cases:

CASE I.—The patient was admitted to the Widener Memorial School for Crippled Children in 1910, when seven years of age. She was suffering from tuberculosis of the left hip which had been present for more than three years. There was considerable thickening about the hip at that time but no abscess formation. A year after her admission abscess formed and opened spontaneously. During the next two years the sinus closed twice and remained healed for some months, but each time reopened. The patient had been steadily gaining weight and her general condition was good. In 1913 the sinus began to discharge profusely and the patient developed an irregular fever and steadily lost weight. By the early part of 1914 both the general and local conditions had become very bad. The soft tissues about the hip and the thigh were gradually absorbed until the base of the neck of the femur, the great trochanter, and two-thirds of the shaft were protruding from the wound. The edges of the wound were of a pale blue and unhealthy color. The wound kept enlarging steadily. She was running a septic temperature with daily variations of four to six degrees. She had been kept under the best of hygienic conditions, being exposed daily to the fresh air, and supplied with the best of food. Intensive dosage of X-ray had been employed without avail, and it seemed but a question of a short

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time until she should die. About the first of April, 1914, we began to expose her naked to the sunshine as advised by Doctor Rollier. About the first of June she was taken to the summer branch of the Widener School at Longport, New Jersey, which is on the seashore, and her treatment by heliotherapy continued. By the first of September her temperature had fallen and was ranging then between 98 and 100 degrees. The wound had begun to show signs of healing. Heliotherapy was continued as far as weather conditions permit during the winter in Philadelphia, and during the summer at Longport. At the end of two years' time her wound was completely healed, her weight had gone from 37 to 61 pounds, her general condition was splendid and she was going daily to the schoolroom. By 1918 her weight was 104 pounds. The wound had remained entirely healed. There was no deformity at the hip-joint, which was ankylosed. In 1919, a skin plastic operation was done to cover over the exposed femur which was visible almost down to the knee-joint. She left the school several years ago and has been earning her living since her graduation. As you observe, the wound has remained entirely healed and the general condition of the patient is all that could be desired.

CASE II.—This child was admitted to the Widener School in 1918, suffering with tuberculosis of the hip. At the time of admission she had fourteen discharging sinuses about the hip. All the structures were boggy and exuding pus. Under heliotherapy her sinuses completely healed in two years and have remained healed since. The soft tissues about the hip and the thigh are firm to the touch and the skin of her entire body, as you observe, is thoroughly browned.

CASE III.—This boy was admitted to the Widener School with a number of discharging sinuses at the hip. He became healed by heliotherapy during the first summer at Longport.

CASE IV.—This boy was admitted to the school last spring. He had numerous sinuses, with profuse discharge, and his hip was very painful. He was practically healed during the summer at Longport.

These few children are presented from among many to serve as object lessons to show how the most severe cases may be cured by heliotherapy within a comparatively short period. There is no question in the minds of many who have employed this method of cure that it is of the greatest value. Apparently hopeless cases have been completely cured within a period of two years, while milder cases are cured within a few months. This method of cure of surgical tuberculosis is largely due to the work and the writings of Rollier. Koffman, of Odessa, some years ago reported very favorable results of heliotherapy as practiced on the shores of the Black Sea, and American orthopædic surgeons have employed it with success both on the seashore and in the interior. Other writers have noted cures on the shores of the North Sea. Rollier's work, as you are aware, has been done in the French Alps, at an altitude of 3500 to 4000 feet.

It has been found that the treatment during the summer months at the seashore is worth very much more than the treatment during the eight or nine

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other months of the year in Philadelphia. Rollier's dictum is that the progress of the cure is measured by the extent of the tanning of the skin. This appears to be true and all are aware how much more readily the skin becomes browned at the seashore or on the water than it does inland. Unquestionably the greatest value from this method of treatment can be obtained in climates where the sun is warm and where there are few cloudy days. Unfortunately in this climate, except in the summer, there are many cloudy days, and in the neighborhood of cities the effect of the sunshine is lessened by the smoke and dust in the atmosphere. At the same time surgeons in whatever locality and climate would do well to employ heliotherapy to the largest possible extent in cases of tuberculosis of bones and joints. Sinuses under this treatment discharge more profusely for a time, but in time the discharge becomes more and more serous and then lessens until finally the sinus heals. Painful joints soon become painless, the appetite of the patient becomes better and his general health markedly improves. Long after the sinuses have closed it is wise to continue the heliotherapy for a period of months and years, as has been done in these cases.

DR. GEORGE M. DORRANCE remarked that he had lately visited Rollier at Lysen and saw there 1200 cases of surgical tuberculosis under treatment. He insists upon rest with moderate extension and gradual active and passive motion. No massage is employed. There were cases that from X-ray examination looked like bony ankylosis in whom he had obtained limited motion. He does not believe in the Albee operation. All plaster cases are removed when the children come to him. He believes that altitude, heliotherapy, rest, and food is the solution of the treatment of bone and joint tuberculosis.

## PERFORATED MECKEL'S DIVERTICULUM

DR. DAMON B. PFEIFFER showed a girl, aged five years, who was admitted to the Abington Memorial Hospital, August 14, 1922, complaining of severe pain in the abdomen. There was no history of indigestion or of abdominal pains. At midnight, prior to admission, she was seized with severe pain in the lower abdomen and vomited three times. The abdominal pain continued, severe and constant. There had been no action of the bowels since onset. On admission at 3 P.M., the pain had abated. She was quiet, her face was pale and slightly pinched, the sensorium unaffected. Temperature, 99.6°; pulse, 120; respiration, 32. Physical examination: The abdomen was moderately distended and tympanitic. Almost board-like rigidity was present. Tenderness was general, but most marked in the right lower quadrant. Faint peristalsis could be heard at long intervals. No peculiarity of the umbilicus was noted. The urine was normal, hæmoglobin was 79 per cent. (Dare), leucocytes 9800. She had been sent to us with the diagnosis of appendicitis, and was operated upon for this condition, the rapidity of onset and extreme rigidity suggesting perforation.

The abdomen was opened by a McBurney incision. On incising the peritoneum there was a gush of thin blood-stained fluid. The possibil-

#### MULTIPLE FRACTURES OF THE PELVIS

ity of intussusception was at once considered, and two fingers introduced for exploration, encountered a movable mass about the size of a walnut. This was withdrawn through the incision, and found to be a loop of ileum with a grayish-yellow rounded mass intimately incorporated with the side of the intestinal wall and the adjacent mesentery. There was a small perforation near its attachment to the bowel, through which a small amount of clear fluid was escaping. From the edges of the perforation there was a slight bloody ooze. The intestines were intensely congested, slightly distended and a few patches of fibrin were seen on the surface. The mesentery was studded with lymph-nodes varying up to 1.5 cm. in diameter. The appearance was that of tuberculous mesenteric nodes, and the larger mass, above noted, seemed to be an unusually large node which had perforated acutely. It was evident that the perforation could not be repaired, and it was therefore determined to make a resection and end-to-end anastomosis, which was done. The appendix was inspected and found to be bound down by adhesions. It was removed. In the belief that the underlying process was tuberculous, drainage was omitted and the abdomen closed in layers.

Convalescence was stormy for the following two days, temperature reaching as high as 103.3 and pulse 156. Distention was extreme. All symptoms then abated rapidly, and on the seventh day her temperature, pulse and general condition reached normal.

Pathological examination of the specimen showed the mass to be a Meckel's diverticulum, greatly thickened, curved upon itself, covered with adhesions and rotated until it seemed to lie within the convexity of the mesenteric border. Evidently a chronic process had existed for a considerable period without exciting localizing abdominal symptoms. The enlarged glands of the mesentery were the local result of absorption.

#### MULTIPLE FRACTURES OF THE PELVIS

DR. H. A. McKNIGHT presented a patient C. L., who was admitted to the Medico-Chirurgical Hospital, February 8, 1922, with a history that she had fallen from a third-story window, landing on the pavement on the buttocks. The patient who was very obese was suffering from acute alcoholism, and was badly shocked; pulse absent at the wrist, skin cold and clammy and temperature 96°.

On examination a separation of the symphysis pubis of over two inches was discovered, another fracture was found on the left horizontal ramus of the pubis, and there was undue mobility of the iliac crest. An X-ray showed: (1) Complete transverse fracture through the left side of the sacrum with displacement upwards of approximately 4 cm. of the fractured fragment of the sacrum. The relations of the fractured fragment to the left sacro-iliac joint were not altered, except that the left side of the bony pelvis was displaced upward. (2) Complete separation of the bones of the symphysis pubis 4 cm. (3) Complete transverse fracture through the os pubis. (4) Comminuted fracture at the junction of the ischium and ascending ramus. (5) Fracture of the descending ramus of the pubis left side, but the line of fracture was not



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clearly and distinctly shown. (6) Tuberosity of the ischium crushed upward, almost obliterating the obturator foramen.

Reduction under ether anaesthesia. The ilium was grasped and pulled downward, one hand in the vagina manipulated the bone of the lateral wall of the pelvis and the patient was placed in a sling. On April 4 another X-ray was taken. Apposition and alignment of fragments of sacrum, ischium and pubis good. Transverse process of fifth lumbar vertebra left side shows upward tilting. The symphysis separation was markedly improved over last examination. There was still separation of approximately 3.5 cm. Examination on discharge from hospital: Ensiform to internal condyle 49 inches on right side. Ensiform to internal condyle 48¾ inches left side. Full motion of the hip on the right side, musculature on right flabby. Muscles of left thigh flabby; patient complains of pain in left thigh on flexion of the leg though the left moves equally with the right. Complains severely without physical cause, except disuse and inaction. Pubic arch nearly closed and not more than ¼ inch separation. No pain on concussion over left iliac area, no mobility nor tenderness at former points of pain. Vaginal examination: No mobility of pubic bones. There is slight impinging of the pubic bones on the pelvic space. Walks with slight limp.

### FRACTURE OF THE SKULL

DR. H. A. MCKNIGHT showed a second case of a patient, M. E., age twenty-four, who was admitted to the Polyclinic Hospital, September 27, 1921, suffering from multiple lacerations of the scalp, stab wounds of the neck, a punctured left eyeball and a fractured skull. The lesions were produced by the blows of a hammer. On admission the patient was semiconscious, the left temporal and parietal regions of the skull were depressed, and on palpation over this area a sensation was transmitted to the fingers as if one were handling a bag of marbles. Brain substance was issuing from the lacerations in the scalp and the left eyeball was collapsed.

Operation was performed at once. A large fronto-temporal flap was made extending to and beyond the sagittal suture; from this lateral extensions were cut to the right along the coronal suture and posteriorly. On raising this flap it was seen that the temporal and a large part of the anterior part of the left parietal bone was comminuted and driven into the brain substance. These bones resembled a tessellated pavement, each mosaic of which had been separated and lying free. The frontal bone was also fractured and the fragments were driven into the frontal lobe. The roof of the orbit was fractured and driven upward, and the nasal bone was crushed and driven upward and backward. The frontal lobe was torn and lacerated.

The bone fragments were removed, the lacerations in the dura closed, after extracting the fragments of bone from the brain, the left eyeball was enucleated and the scalp wound closed with drainage. On October 8th, a neurological examination, a slight weakness in the right grip, a suggestion of a Babinski on the right. There is some confusion and

## SUBACUTE MASSIVE PROCTITIS

memory loss of the time of the accident and the time immediately following. Memory for details of the exact present is incorrect. This is no more than is to be expected from the site of the injury. Patient had an uneventful recovery. The wound healed by first intention and she was discharged from the hospital October 17th. At this time there seemed to be no mental nor motor disturbances.

## SUBACUTE MASSIVE PROCTITIS

DR. E. L. ELIASON, not having been able to find any description of a similar condition, presented the following case:

Case No. 8535, Mrs. J. P., age thirty, had been sick for five weeks, being seized in the beginning with cramp-like pains in the lower abdomen, associated with backache. A diagnosis of extra-uterine pregnancy was made, but operation was refused. Four weeks later she was again seized with pain in the lower abdomen, most marked on the right side, associated with vomiting and constipation, temperature of 100 to 101.

The patient was somewhat jaundiced at time of examination and was found to have a distended, tender abdomen, with some rigidity and especial tenderness in right iliac fossa. Palpation found a mass here, just under the rectus muscle, and extending to its outer border. It was hard, smooth, fixed, and somewhat tender. Vaginal examination revealed a very high-placed uterus, the cervix being barely within reach of the finger. The uterus was freely movable and the appendages showed no evidence of pathology. Posterior to the uterus was a marked massive induration bridging over the rectum and extending down on each side almost to the anal canal. Rectal examination revealed an indurated, rigid rectal wall constricting the lumen so that it admitted only the examining finger. A diagnosis of pelvic abscess secondary to a ruptured appendix was made. Leucocytes, 17,000. Wassermann, negative.

Patient was operated at Howard Hospital through right rectus incision. The abdomen contained a quantity of bile-stained fluid. The gall-bladder, appendix and Fallopian tubes were normal. Further examination revealed a rigid, indurated and markedly enlarged oedematous rectum and lower two inches of sigmoid. The condition evidently had existed some time, for the tissues pitted only with continued firm pressure. The rectum could not be compressed or moved the slightest. It presented a yellowish, smooth semi-translucent appearance, due to the bile-stained oedema. No fecal impaction existed. Left inguinal colostomy was performed. One week later, under hot rectal irrigations, twice daily, examination showed decided local improvement. Three weeks after colostomy patient began having bowel movements per anum. Examination found oedema and induration entirely gone. Four weeks after operation the colostomy was closed by excision and end-to-end anastomosis. Pelvic examination through the abdominal wound demonstrated a normal sigmoid and rectum. Patient to-day is perfectly well; has gained forty pounds. Bowels are regular with use of paraffin oil occasionally.

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DR. GEORGE P. MULLER recalled a case operated for carcinoma of the rectum in which he noted a tremendous thickening of the wall and narrowing of the lumen for six or seven inches. Recently in a patient with diverticula of the colon, in addition to many small diverticula there were three local processes, one below the splenic flexure, one at the beginning of the sigmoid, and another at the rectum. He could feel a mass low down in the pelvic colon near the bottom of the peritoneal reflexion. It was distinct and felt like the one Doctor Eliason described. The case might have been one of small diverticula surrounded by exudate, as one rarely sees the diverticulum and yet the peritoneal diverticulum may be behind. In 1910 in *Surgery, Gynecology and Obstetrics* a case was reported where the lower sigmoid was surrounded by a mass of tissue obliterating the lumen. Braun reported a case of tumor of the sigmoid and says that this condition is entirely distinct from malignant disease.

DR. DAMON B. PFEIFFER said he had never encountered an exactly similar condition, but had seen some cases which probably fell into the same group. The interstitial inflammations which affect the rectum and large intestine are not as yet thoroughly understood. Inflammation and pathologic changes, consequent upon infection by the amœba, the various strains of dysentery bacilli, by tuberculosis, syphilis, and occasional rarer types of infection, are well known, but there remains a residuum of cases of severe and even fatal proctitis and colitis, the etiology of which is unknown. Such cases occur sporadically throughout the entire United States, and in the aggregate there is an enormous number of them, but as yet insufficient attention has been accorded them by the profession. Many of these cases present a symptom-complex so similar that it seems probable that they represent a distinct clinical entity; though as yet, no satisfactory designation has been given to them. Probably the most common term is chronic ulcerative colitis. This is unsatisfactory, because in the early stages the condition is simply a diffuse inflammation of the wall of the bowel, with a characteristically thick, opaque, red, friable and bleeding mucous membrane. Also in the latter stages, ulceration may have been largely or entirely overcome, leaving scarring, contraction, more or less absence of haustration, and frequently polyp formation.

It must be noted that all these more serious manifestations are interstitial inflammations and the thickening of the bowel wall may be extreme. Frequently, the entire large intestine and rectum are involved, but at times only a localized segment is affected. The rectum almost always participates. By analogy, it seems reasonable to infer that all these processes are infective in origin. Culturally, many varieties of pathogenic bacteria have been obtained, but it is difficult in the presence of the intestinal flora to be certain as to the rôle played by each. It seems probable that the pathogenic micrococci can produce a diffuse inflammatory condition of the large intestine, but the conditions which predispose to such infection are unknown. Of course, one could not rule out the possibility of infection by some organism or organ-

#### SUBACUTE MASSIVE PROCTITIS

isms as yet undiscovered. It seems to me that Doctor Eliason's case would fall into the group of non-specific interstitial infection of the rectum and colon. It is remarkable in its degree and its localization.

DOCTOR ELIASON, in closing, remarked that he had seen a condition similar to the case cited by Doctor Muller, from whom he had removed the appendix and who six days later developed an intestinal obstruction. Upon opening the abdomen, no cause could be found for the obstruction; the gut was distended down into the pelvis; here the hand felt the rectum similar to the one just described. It was probably an interstitial proctitis.

TRANSACTIONS  
OF THE  
NEW YORK SURGICAL SOCIETY

*Stated Meeting Held December 13, 1922*

DR. ELLSWORTH ELIOT, JR., in the Chair

CANCER OF PROSTATE

DR. WILLY MEYER presented a patient, now seventy-two years of age, who had been under his care since November, 1917. He had been seen previously, in September, 1917, by Doctor Barringer, who took him to the General Memorial Hospital for radium treatment, without improvement. He showed the pathognomonic signs of cancer of the prostate gland and it was considered advisable, in view of his general condition and age to avoid a radical operation but to again try radium. A water-tight suprapubic fistula was established according to Witzell through a stab in the bladder. The radium treatment was begun immediately. In all he received eight therapeutic applications of radium per rectum and over the symphysis, and about twenty-five prophylactic applications. Today the patient is in splendid health and travels in comfort. He still wears his catheter. It has been thought inadvisable to discontinue the catheter. The fistula is water-tight, he receives careful attention, and the bladder is washed out regularly. Rectal examination shows the prostate much shrunken, flat and hard. The nodular condition has disappeared.

DR. EDWIN BEER asked if the patient could urinate. Without microscopic confirmation one should be chary of subscribing to a diagnosis of carcinoma. Numerous cases of non-carcinomatous prostates (adenoma prostatitis, prostatic stone) may closely mimic malignancy. There is also a marked variability in the life history of prostatic carcinoma quite independent of treatment.

DR. MEYER replied that the patient could urinate. There could be little doubt as to the diagnosis of carcinoma; the tumor had been nodular, the trouble had developed quickly and the patient certainly had been in no condition for radical operation.

RADIUM BURN OF FOOT

DR. WILLY MEYER showed a second patient who had had a general eczema for which radium was applied on the left foot behind the inner malleolus for twenty minutes. After two or three weeks an ulcer developed. We know that radium produces a sclerosis of the nourishing blood-vessels exposed to it and that this has to be considered in every case of a radium burn. Usually these ulcers due to radium or X-rays do not heal; they are extremely obstinate. As the only possible alternative to excision, hyperæmic treatment was considered. It consisted



#### FISTULA FOLLOWING NEPHRECTOMY FOR TUBERCULOSIS

of wearing a rubber bandage around the thigh over night and regular cupping. This treatment was kept up for about ten weeks and the result is that the ulcer has healed and has remained so for eight months.

#### FISTULA FOLLOWING NEPHRECTOMY FOR TUBERCULOSIS

DR. WILLY MEYER presented another patient, twenty-six years old, who in 1919, presented signs of a suppurating kidney. Cystoscopic examination demonstrated thick pus escaping from the left ureter; the right kidney negative. Operation was planned in two stages with local anaesthesia, but it was found that there was not a single large sac that could be drained; the kidney was typically tubercular. Therefore she was given a general anaesthetic and the organ was shelled out of its much thickened capsule. A mass ligature, applied low down, surrounded the voluminous lower part of the pelvis. The ureter had to be left in place. The entire wound was left open and it healed nicely up to a sinus.

Several earlier cases of tuberculous kidney where the kidney was shelled out from its capsule, had later developed a sinus. They had been successfully cured with the injection of a solution of sulphate of copper and sulphate of zinc in water. In this case this treatment was tried twice, but the sinus persisted. Having seen a patient with a persistent sinus in tuberculous empyema benefited by the light treatment, the Kromayer lamp with a special quartz probe was used in this case for several months. Twice the wound healed, but reopened. The radio-therapeutic department of St. Luke's Hospital was asked to take an interest in the case, and there she was submitted to intermittent X-ray treatment. After some time the wound closed and has remained closed now for over eight months. The patient is in good health and apparently cured.

DR. JOSEPH WIENER said that he had been able to cure sinuses in every part of the body with the Coolidge tube, but the best results had been accomplished in cases of tuberculosis. A powerful X-ray tube is used and the light is filtered so that the soft rays do not reach the patient. This treatment is of great value for sinuses of every kind, even of the bone, but the results are most striking in those cases in which tuberculosis forms the etiologic factor.

DR. EDWIN BEER remarked that unfortunately these tubercular cases are followed too often by persistent and rather obstinate sinuses. Doctor Meyer's remarks would lead one to believe that if more of the ureter was taken out this would not occur, but statistics fail to confirm this. Even after complete aseptic uretero-nephrectomy, lumbar sinuses are quite frequent. In Doctor Meyer's case he left the capsule of the kidney, and this might be an explanation for the persistence of the sinus as it probably was tuberculous. It was the speaker's own opinion that frequently this was a secondary hæmatogenous infection of the musculature following the manipulations incidental to nephrectomy. In these obstinate cases one is forced from one treatment to another. Cases have been known to drag on for as long as four years and then close. X-rays, heliotherapy, or bismuth injections, etc., all have to be tried to assist in closing

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these chronic sinuses, but no one therapeutic measure seems to be regularly successful, and it is difficult to decide which therapy has been effective, as so many close under ordinary surgical measures.

### EXTRAPLEURAL THORACOPLASTY FOR PULMONARY TUBERCULOSIS

DR. WILLY MEYER also presented a patient who four years ago came under his care in a much reduced condition with bilateral pulmonary tuberculosis. He decided to do an extrapleural thoracoplasty in two stages, and this procedure was carried out on November 18, and on December 10, 1918, resecting the sixth to tenth rib first, and the second to fifth rib at the second sitting. (The case was described in *Surgery, Gynecology and Obstetrics*, February 1920.) On the outside of the chest elastic compression was also employed. The patient has done very well. All his former symptoms as well as the bacilli disappeared and he was able to attend to his work. The röntgenogram shows that the other lung is in good condition; the one operated on shows a total collapse with connective tissue proliferation. It is of interest and importance that today surgery is indicated in advanced cases of pulmonary tuberculosis which medical and careful hygienic treatment have failed to help. And surgery will improve or cure 60 to 70 per cent. of these cases.

DR. HOWARD LILIENTHAL said that he had had some experience in these cases and considered that the marvellous improvement that takes place soon after the operation is quite extraordinary. Extrapleural thoracoplasty has the great advantage of fixation of the chest in addition to setting at rest the lung itself. The fixation is accomplished not only by the position of the ribs but by the bridge of bone which forms and cements them together. Part of the phrenic nerve should first be extirpated on the affected side. The results have been excellent. The speaker had only lost one case and in this, unexpected disease of the other lung had developed.

DOCTOR MEYER, in closing the discussion, said that there lately appeared an excellent article by Goetze of Frankfort from Professor Schmieden's clinic, in which it is advised that the operative treatment of lung compression should best commence, in certain cases of advanced pulmonary tuberculosis, with the resection of the phrenic nerve. It was also stated in this article that patients who have been treated with artificial pneumothorax should not be discharged before the phrenicotomy had been added.

### LIGATION OF COMMON ILIAC WITH FASCIAL STRIP FOR ANEURISM

DR. JOHN DOUGLAS presented a man twenty-five years of age who had suffered a compound fracture twelve years previously, infection of which necessitated an amputation at junction of the upper and middle third of the left thigh. He was all right until five years ago when he noticed a mass in the gluteal region. He entered Bellevue Hospital at this time where a diagnosis of sarcoma was made. An incision was made for diagnostic purposes, and the mass was found to be an

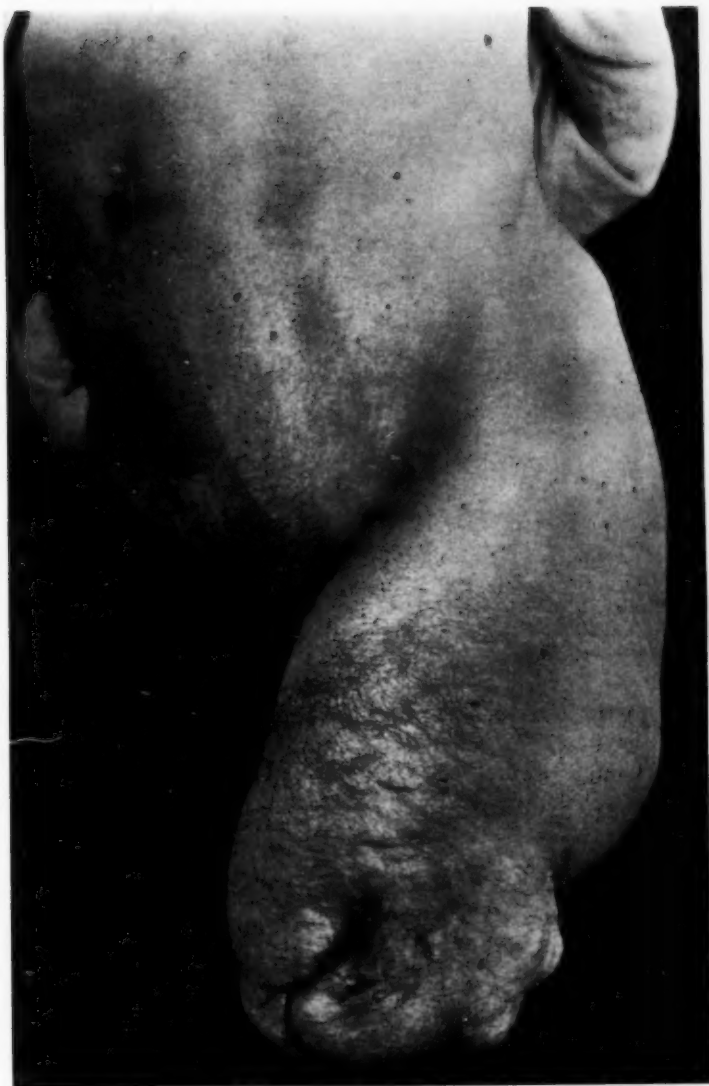


FIG. 1.—Ligation of common iliac with fascial strip for aneurism.



## LIGATION OF COMMON ILIAC WITH FASCIAL STRIP FOR ANEURISM

aneurism, probably of the gluteal artery. No further operative procedure was carried out at this time. Two years ago he developed large veins on the stump of the thigh and in the scrotum and penis, and he was operated on for varicocele. The veins on the stump continued to increase in size as did the mass in the gluteal region, and he suffered severe pain in the region of the hip joint. He entered Bellevue Hospital on June 1, 1922.

At this time the end of his stump was occupied by a large mass of tortuous veins (Fig. 1) extending half-way up to Poupart's ligament. These veins were one-half to almost a centimetre in diameter, were compressible and a distinct thrill could be felt and bruit heard over it. This thrill and bruit, as well as the pulsation, could be detected extending well up above Poupart's ligament, apparently extending as far as the common iliac artery. There was also a hard, more deeply situated pulsating mass in the gluteal region over which also might be detected a bruit and thrill. Radiographic pictures showed an erosion and destruction of the inner half of the remaining portion of the femur at the lower third. There was also evidence of pressure erosion in the descending ramus of the pubis and ascending ramus of the ischium. Wassermann negative.

At the operation which was done on June 10th, access to the vessels being obtained through an incision above and parallel to Poupart's ligament and extending above the spine of the ilium, the peritoneum being reflected inward, the following condition was found: The external iliac was lengthened, tortuous and dilated, and before passing under Poupart's ligament, showed a fusiform aneurismal dilatation. It was about 1.5 centimetres in diameter. The internal iliac was also elongated, tortuous and dilated. The common iliac was dilated to a diameter of 2.5 centimetres, this dilation extending upward but becoming less as it approached the bifurcation of the aorta. The iliac veins were also dilated. A strip of fascia lata 25 x 2.5 centimetres was removed from the outer side of the right thigh. This was passed around the common iliac about five centimetres above the bifurcation, a knot was tied in the fascia, a chromic-gut suture was passed through the knot to prevent slipping. The fascia strip was then passed twice more around the vessel and again sutured. At the end of the operation no pulsation was felt in the external or internal iliac artery. The reason for using the strip of fascia rather than the ordinary ligature material was that the vessel was so much dilated, so large in calibre and so thin and probably diseased that it was believed that the chance of ordinary ligature material cutting through the vessel and the possibility of secondary hemorrhage would be lessened by using the broad fascial band. It was of course impossible to go above the dilated area to tie in normal tissue as is the ideal method of ligation to cure aneurism, as the dilatation extended up to the bifurcation of the aorta.

The patient made an uneventful recovery and was discharged from the hospital two weeks after his operation. One week later at the return clinic he had some painful thrombosis of the veins over the site of



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amputation, but at the present time, while these thickened veins can be felt, there is evidently no blood circulating through them and there is no pulsation in the gluteal aneurism which has markedly diminished in size and the patient is free of pain.

DR. ALEXIS V. MOSHCOWITZ could not understand why Doctor Douglas feared to ligate that vessel. It was dilated, to be sure, but apparently not diseased. The speaker ligated both the common and the external arteries at the same time with happy results.

DOCTOR DOUGLAS replied that he had remembered Doctor Moschcowitz's case but the diameter of the common iliac, in the patient presented, was between two and three times as large as was normal, with the wall distended and thinned out. He had felt that the use of either silk or catgut would make the vessel more likely to rupture as a result of cutting through with such fine material rather than with the thick strip of fascia. In Doctor Moschcowitz's case the ligation was done on a normal vessel wall which had been eroded by pressure. In the patient shown tonight quite a different condition existed.

### TUBERCULOUS PERITONITIS

DR. CHAS. N. DOWD presented a patient, M. F., Roosevelt Hospital Surgical history, A18570, who gave an unusually long period of observation and a corresponding opportunity for studying the natural history of tuberculous peritonitis. Twenty-one years ago, when five years old she was admitted to St. Mary's Hospital for Children; Doctor Dowd operated for tuberculosis peritonitis and found the peritoneum studded with myriads of tubercles and the omentum contracted into a thick mass. She had much ascites at that time. A simple incision exposed the abdominal contents to air and to the trauma of examination and was then closed. She was then reasonably comfortable for several years. Eight years after her primary operation, a sinus opened in the original abdominal incision, discharging for a week and then closing spontaneously. Between 1913 and 1916, she had considerable abdominal pain. In January, 1916, fifteen years after her primary operation, she was admitted to the Roosevelt Hospital, on account of attacks of vomiting and pain in the region of the appendix.

*Second Operation.*—The appendix was removed. It showed no gross lesion, but the walls were more thickened than normal, possibly 2 or 3 times the normal. This gave an opportunity of studying the condition of the peritoneum. There were no visible tubercles in the region where there had formerly been so many. There were a few adhesions about the uterine appendages. The vermiform appendix was covered in by adhesions which attached it to the wall of the cæcum. The caput coli was thickened, so that it was not possible to bury the stump of the appendix in the ordinary way, but no active tubercles were present. The scar of the old incision was excised and the muscles there looked particularly strong and well nourished and the wound healed primarily. Examination of the microscopical sections from the

#### INTUSSUSCEPTION IN ADULT DUE TO ADENOMA IN ILEUM

appendix and from the tissue of the abdominal scar showed no evidence of tubercle tissue.

She then continued reasonably well for about five years when she again came to the Roosevelt Hospital, September 30, 1921, on account of severe pain in the lower part of the abdomen. She had lost twenty pounds in the previous year.

*Third Operation.*—October 3, 1921 for the relief of excessive paroxysms of pain in the lower part of the abdomen. At this operation the ovaries and tubes were found encased in inflammatory tissue and were removed, excepting a small bit of the capsule of one ovary which looked normal and the base of one tube which seemed suitable for plastic repair. There was much inflammatory tissue about the uterine appendages and it was not possible to tell at that time whether the inflammation indicated fibrosed tuberculosis or some other type of inflammation. At this time further examination of the peritoneum was also possible. There was no evidence of tubercles on the parietal or intestinal peritoneum or about the caput coli. Microscopical examination of the tissue removed showed bilateral tubercular salpingitis.

Had we been positive that the inflammation in the uterine appendages was tubercular, a complete removal of the tubes, ovaries and uterus might have been considered desirable. However, she has gained twenty-four pounds in the last year. She is free from pain and feels well. Inasmuch as all tissue was removed which looked inflammatory we may well believe that the procedure was the correct one.

*Summary.*—1. She dealt successfully with her tubercular peritonitis which was scattered throughout the peritoneum, at the time of her operation in childhood. 2. Although she was able to control this general tuberculosis, she was not able to control the localized tuberculous inflammation which collected about the ovarian tubes. 3. She has improved satisfactorily, since the removal of localized pelvic tubercular tissue.

#### INTUSSUSCEPTION IN ADULT, DUE TO ADENOMA IN ILEUM

DR. CHAS. N. DOWD presented a man twenty-seven years, who was admitted to the First Surgical Division of the Roosevelt Hospital, March 28, 1922. History, A 19311. He complained of paroxysmal attacks of epigastric pain which had troubled him more or less for the past six months, and which had been associated with vomiting. The recent attacks had become very severe and on admission he had been vomiting and bright red blood had come from the rectum. After reaching the hospital, he showed definite symptoms of intestinal obstruction and an operation was manifestly necessary. A six inch median supra-pubic incision was carried a little to the left of the umbilicus. A large mass of congested intestine was found and on delivering it, it proved to be an intussusception of the small intestine. The intussusceptum had slid into the intussusciens about eighteen inches. It could not be reduced by traction, but by pressing it was pushed back about eight or nine inches. The coating of the intestine then cracked and there was a distinct hole about one-quarter of an inch in diameter. This was sewed

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up by catgut and two rows of thread. The intestinal wall also cracked and perforated at a lower place in the intestine, therefore a resection was done. Apparently thirty inches or more of intestine were resected. The mesentery was tied off in separate ligatures, before it was cut. There was very little bleeding from the mesentery. The edges of the intestine were cauterized beside the clamps. These ends were then closed by Glover's chromic stitches, and outer Cushing's stitches. The entire row was reinforced by a Cushing row of silk sutures. Lateral anastomosis was then made, two rows of chromic gut, inner with Glover's stitches and outer Cushing's stitches. He made an excellent recovery and left the hospital April 27th. He has been well ever since.

The intussusception was caused by a benign adenoma which was about 2 cm. in its diameter. It had grown in the intestinal wall, had projected into the intestinal lumen and had formed the apex of the intussusception. Intussusception does not often occur in the small intestine. It usually comes in the region of the ileocecal valve. Clubbe in his recent monograph states that in 97.6 per cent. of his two hundred and fifty-three cases, the intussusception had started at or near the ileocaecal valve.

Adults do not often have intussusception unless a tumor causes it. Adenomas of the small intestine are rare. Ewing does not give them separate mention in his book on "Neoplastic Diseases," and other authors usually do not refer to them in this location or state that they are very common. Hotchkiss presented a somewhat similar case to this Society in 1916, due to an adenoma. James & Sappington of Philadelphia reported, 1917, a case of intussusception due to benign fibroma. They were able to collect only twenty-four similar cases from the literature. Eliot & Corscaden presented a very careful report of "Intussusception in the Adult," in 1911, in which they analyzed three hundred cases. One-fifth of them were due to benign tumors. Thirty-four per cent. of the benign cases were situated in the ileum.

## ECHINOCOCCUS CYST OF LIVER

DR. CHAS. N. DOWD also presented the case of J. B. History number A 20110. Age twenty-eight, admitted to the First Surgical Division of the Roosevelt Hospital, October 15, 1922, complaining of sudden sharp pain in the region of his liver and the upper right quadrant of the abdomen. He had been in the hospital two years previously. Otherwise his health had been good. He was a native of Greece. He had been in the United States nine years, and during that period had worked in factories in different parts of the country and on a farm in the middle west. Hæmoglobin 80. Polymorphonuclears 78 per cent., white blood cells 19,900. Blood pressure 115-75, red blood cells 6,300,000. Clotting time 5 minutes. Group 11. Differential blood count:—Neut. 84, Eosi 5, Baso. 3, Mono. 3, L. Lym. 3, S. Lym. 5.

A six inch incision through the upper part of the right rectus. The gall-bladder and stomach showed no abnormality. There was however,

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embedded in the under part of the left lobe of the liver, a projecting irregular shaped cyst. On incision, it showed echinococcus material which exuded, and many small daughter cysts and a considerable amount of irregular shaped whitish cyst wall tissue. At this time, it seemed wise to close the opening in the cyst so as to prevent the spread of infection. It was feared that the walls of the cyst would be ruptured and that all endeavor to enucleate the cyst would lead to the spread of the disease.

We are not accustomed to seeing many cases of echinococcus cysts in the Roosevelt Hospital. There have only been five such cases in the last seven years. This differs from the frequency in some other hospitals in this vicinity and differs very materially from conditions found in other countries; for instance in Argentina, they are said to be so common that the possibility of echinococcus disease is the first one which comes into the mind of the surgeon who is examining for abdominal surgical lesions. The results from operation there are said to be favorable in a large percentage of the cases, and enucleation is frequently accomplished. One of the visiting surgeons from South America has been enthusiastic over the results thus obtained. In Iceland also, although they are not so common as they used to be, there are still a good many echinococcus cysts, and we learn that drainage has led to good results there when enucleation was impossible. This patient made a satisfactory recovery from the first operation. We believed that it might be possible to enucleate the remaining portion of the cyst completely or failing to do that it might possibly be marsupialized.

A second operation was therefore done through the upper part of the left rectus muscle and the wall of the cyst was found much firmer than at the previous operation; a cleavage layer was found between it and the liver, which enables us to remove the cyst without undue trauma to the liver. Two cigarette drains inserted and wound closed to emergence of these drains. He is apparently cured.

An interesting side light on the surgery of the liver was noticed in the recovery of this patient. The cyst was enucleated from the liver very much as an adherent gall-bladder is taken away. There was a definite drainage of bile for several days after the operation. When such a drainage comes after cholecystectomy, one sometimes wonders whether it comes from the liver or from the cystic duct. The drainage in this instance has proved that bile may well come from the raw surface of the liver where an embedded object such as this cyst or a gall-bladder has been removed.

## RELATIONSHIP BETWEEN INTESTINAL OBSTRUCTION, CHRONIC PERITONITIS AND MULTIPLE SEROSITIS

DR. CHARLES N. DOWD read a paper with the above title. (See page 423.)

In discussion of which DR. EDWIN BEER thought it might be of interest to relate a case operated on at Bellevue Hospital within the last few weeks which corresponded to one of the cases Doctor Dowd reported in his paper. When the patient came to the hospital he had been ill for only three days. Examination showed a mass, firm and non-tender, behind the rectus



muscle in the right iliac fossa. X-ray was immediately taken with the idea of locating the obstruction by the gas distention in the bowel which gives a clear picture, and it was found that the ascending, the transverse and the descending colon was empty, but the small intestine was distended. This method of diagnosis is very valuable and has been used frequently. Immediate laparotomy was done by Doctor Kellogg and almost the whole intestine was found bound together in a sheath of white membrane. All the small intestine and the ileum were involved in this mass of tissue. The patient died, but the autopsy was very instructive. There was no adherent pericardium (Peck's pericarditis, pseudocirrhosis) and there was no endophlebitis of the hepatic veins. The liver and spleen were covered with this white membrane and the lower part of the ileum and cæcum and ascending colon were covered by the membrane which was as white and thick as a visiting card. Besides, there was a mass in the pelvis, a retroperitoneal lipoma, and the patient had a lipoma in his neck. There was fluid in the peritoneum. His case corresponds rather accurately with Doctor Dowd's case of polyserositis and would be classified as an "iced liver" and "iced spleen" (so called Zuckergus) with chronic productive peritonitis. The speaker believed these cases to be more common than Doctor Dowd's report suggests, although it must be admitted that they are very unusual on a surgical service.

DR. HENRY H. M. LYLE said that in working up the subject of linitis plastica in 1911, he was very much struck by the number of times this condition was associated with the condition described by Doctor Dowd, especially with some cases reported by Krompecher. The details, conclusions and literature will be found in the article Linitis Plastica by H. H. M. Lyle, *ANNALS OF SURGERY*, November, 1911. Krompecher holds that gastro-intestinal sclerostenosis is not a mere disease of the pylorus, but is found in the intestines and peritoneum, and that it is the result of a chronic venous œdema caused by cardiac insufficiency and arteriosclerosis, and that the pathological process bears a close relationship to scleroderma.

DR. HOWARD LILIENTHAL called attention to the danger of appendectomy in cases in which there is a suspicion of tuberculosis. In two cases that he knew of where this was done the union broke down and the patients had permanent fistulas. This warned him not to take out the appendix unless there were symptoms which would make it imperative. He understood Doctor Dowd to say that he had been unable to invert the stump.

DR. CHARLES GORDON HEYD said that he had had the opportunity of observing the life history of a patient with tuberculous peritonitis. In August, 1916, the patient was moribund with marked ascites and a laparotomy was performed under local anæsthesia and the abdominal cavity irrigated with 50 per cent. hydrogen peroxide solution. In September, 1920, the patient was reoperated upon for a mass in the right lower quadrant of the abdomen. Upon laparotomy the upper abdomen was entirely free of any evidence of tuber-



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culous mass and a salpingo-oöphorectomy was performed. The left tube and ovary were not involved. In February, 1921, a third laparotomy was performed for intestinal obstruction. Aside from some adhesions of the omentum to the anterior abdominal wall there was no evidence of any tuberculous process in any portion of the abdomen. When last seen about three months ago, the patient was entirely well. In regard to chronic multiple serositis Doctor Heyd was under the impression that ascites was essential to the diagnosis and many of the cases of multiple serositis were extremely chronic. In Osler's cases a child was tapped 121 times and Rumph's patient was tapped 301 times and there was in the literature a reported case in which 600 gallons of ascitic fluid was removed within a period of five years. It seemed that there were many cases of hyperplastic peritonitis with mucosal obstruction which were accidentally discovered on laparotomy. Whether these belong to the group of multiple serositis was doubtful as it would seem that the history of ascites was essential in establishing the clinical entity of chronic multiple serositis.

DR. ELLSWORTH ELIOT, JR., also spoke of the removal of the appendix in a case of tuberculous involvement. He thought a distinction ought to be made between those cases in which the tuberculosis was part of a general involvement of the peritoneum and those in which the tuberculosis was limited to the appendix alone. Of the latter type he had had three cases in which the removal of the appendix was not followed by any untoward result, the wound healing without difficulty. Of tuberculous peritonitis he recalled one case, a five year old child, in which, after the usual operation, a fecal fistula developed. With ordinary cleanliness, good care and nursing the fistula closed spontaneously. Fifteen years afterward the patient, then an adult, enjoyed perfect health with no indication of tuberculosis in any part of the body. Such cases of "healed" tuberculosis, although at the time of operation limited to the peritoneum, are not necessarily safe from recurrence, either in the peritoneum or in other parts of the body. Once tubercular, patients are subject to the danger of relapse even though they may continue in perfect health for a number of years.

DOCTOR DOWD, in closing the discussion, said that the removal of the appendix in the case of tuberculous peritonitis was done fifteen years subsequent to the discovery of the tubercles in the abdomen, and at a time when there was absolutely no evidence of active tuberculosis. Doctor Heyd's remark about ascites is in conformity with the usual description of multiple serositis, for it has usually been the ascites which has called attention to the disease, but this ascites is not always present. The profession is indebted to Doctor Mayo for again calling attention, last summer, to the possibility of extensive disease without ascites. We may well believe that many cases exist in whom the disease escapes diagnosis because ascites is not present.

## CORRESPONDENCE

### THE URETER VERSUS THE APPENDIX IN RIGHT-SIDED ABDOMINAL LESIONS

EDITOR ANNALS OF SURGERY:

Sir:

An healthy skepticism should be entertained for an appendix whose sole plea for removal is the detection, by the examiner, of an ill-defined iliac tenderness, and a total absence of a substantiating, clear-cut, acute history. In a recent review of errors committed by myself and others, it was found that, in both acute and chronic conditions, a heavy toll is exacted of the benign appendix by reason of its close affiliation with the right ureter. There are classical cases so typical of the appendix and also of the ureter, that one cannot be easily misled. I wish, however, to stress some of the baffling features which may be encountered by giving a brief recital of the salient points from a few case histories.

In a consideration of acute conditions, it must first be borne in mind that one of these tubular structures, the ureter, is extra-peritoneal, while the other, the appendix, is intra-peritoneal. Consequently, if the lesion be in the ureter, even though the pain be great and the elevation of temperature marked, two of the cardinal symptoms of serious intra-abdominal mischief, *viz.*, muscular rigidity and pronounced increase of pulse-rate, will not be conspicuous. The defensive, board-like spasm of the flat muscles of the abdomen, as an expression of resentment to peritoneal insult is well known to all; yet the finer degrees of such expression will often escape detection because of the rough tactics employed. The gentler palpation, the feather touch, are capable of conveying most valuable information. Furthermore, the very high temperatures, 103, 104 or 105° F., point, as a rule, not to the appendix, but to the ureter and pelvis of the kidney; provided, always, that a pneumonic condition of the lower lobe of the right lung can be definitely excluded.

#### CASE REPORTS

CASE I.—A corpulent man of forty was suddenly seized with violent loin pain, practically no nausea and no vomiting, no temperature, a normal pulse and no abdominal rigidity or tenderness. The history revealed the passage of a renal calculus some seven years previous and the urine showing in the present attack many red blood and pus cells. Forty-eight hours after onset, feeling much better, he left his bed, exerted himself somewhat, and had a sharp return of pain. When again seen on the fourth day of his illness, the temperature was 102 F., pulse 115, leucocytes 18,000, no tenderness over the abdomen proper, but marked tenderness in the right loin and just above the highest point of iliac crest. The urinary findings were not now so marked, no blood cells and only an occasional pus cell.

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The diagnosis was now fairly clear; not an ureteral stone, as was first concluded, but a ruptured retrocæcal appendix as was subsequently revealed by operation.

CASE II.—An elderly woman of sixty-four, first seen twelve days after onset of present trouble. At no time had she felt acutely ill and had been up and about most of this time. The history revealed many attacks of cystitis with a probable complicating pyelitis. Examination showed a rather large mass, not very tender, in the right kidney region and extending somewhat downward, temperature of 101.5 F., pulse 90, and leucocytes 16,000. The urine from the right kidney showed many pus and blood cells, the pyelogram was negative for renal stone or tumor and the barium enema revealed no tumor of the large bowel and no obstruction. Operation, under local anæsthesia, because of hypertension and cardiac involvement, displayed a high-lying appendix abscess, securely fortified by a large mass of omentum.

These cases well illustrate the acute rampages of the appendix masquerading under predominating urinary symptoms.

CASE III.—A young girl of twenty is suddenly seized at 5 A.M., at the end of a menstrual period, with severe pain in abdomen, some nausea, marked tenderness in right iliac fossa and presenting practically no rigidity of abdominal muscles. The temperature is 101.5 F., pulse 100, leucocytes 19,000, with 90 per cent. polymorphonuclears and the urine is pus and blood free. This was the fourth attack of a similar nature occurring over a period of one and one-half years. The attending physician had previously diagnosed an acute appendix. This opinion is concurred in, immediate operation is performed with the finding of a benign appendix and a normal peritoneal cavity. The catheterized urine, on the following day, shows many pus cells and cystoscopic studies after convalescence revealed a dense ureteral stricture 4 cm. above the bladder, with a complicating pyelitis.

Two points in this history are significant: The absence of rigidity and the appearance of the attack at the end of the menstrual period. Deaver (*Archives of Surgery*, Jan., 1923) holds that attacks of right-sided pain occurring at this time are suggestive of a chronic appendix. My experience in ureteral stricture work has led to the opposite conclusion; that is to say, attacks of pain coming on during, or at the end of, a menstrual period serve to incriminate the ureter and to eliminate the appendix.

CASE IV.—A young married woman of twenty-three is taken acutely ill with severe abdominal pain, nausea, vomiting, temperature of 102 F. and exquisite tenderness over right iliac fossa. So clear seems this diagnosis that she is immediately rushed to the hospital and sectioned forthwith. A normal appendix and a normal peritoneal cavity are found. Further post-operative studies reveal a blood laden with plasmodia malarie, a urine with blood and pus and feces containing many hookworms. Convalescence is uneventful and the patient leaves the hospital on the eighth day. On the tenth day, she is again seized with agonizing pain and shortly thereafter passes an irregular, jagged calculus per urethram.

The average acute abdomen will permit of sufficient time for a study of the blood, the urine and possibly an X-ray. However, in the face of stormy symptoms, too much time is not to be consumed in scientific speculation. The fulminating appendix brooks no delay; better, by far, to remove more benign appendices than, by tardy tactics, to permit one malignant one to have full sway. So long as man continues to harbor this vestigial structure within his abdomen, just so long will these acute tragedies continue to confront the surgeon.

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What constitutes a chronic appendix? Many pathologists deny the existence of chronic appendicitis, interpreting surgical chronic appendices as healed or healing lesions, the result of previous infectious processes. Codman, in a carefully studied series of ninety-eight operated cases of chronic appendicitis, found pathologic evidence of disease within the appendix in only sixty-one, and of these, fifty had definite histories of one or more classical acute attacks. Deaver, in analyzing five hundred operated cases of chronic appendicitis, states that there were twenty-seven different varieties of these chronic appendices as reported back to the surgeons from the laboratory. Robert T. Morris would have us believe that the appendix, because of its vestigial nature, is peculiarly prone to involutinal changes with connective-tissue formation, and thus becomes a perpetual source of irritation to the ganglia of the sympathetic nervous system. He describes, as diagnostic of chronic appendicitis: tenderness, located, not over McBurney's point, but over a point about one and one-half inches to the right and one inch below the navel, which point is from one to three inches from the classical McBurney's point. This point is an important one and should always be carefully palpated, for the reason that it defines the spot where the right ureter crosses the pelvic brim; consequently, marked tenderness here reflects, as a rule, not upon the appendix, but the ureter, as the more likely source of the trouble.

It matters but little what the pathologist may or may not have to say; the trained surgeon has learned to recognize the gross, macroscopic battle-scars inflicted upon an appendix which has previously been the seat of definite infection, the manifestations of which are to be seen in (a) pronounced peritoneal adhesions; (b) sharp kinking; (c) definite stricture of lumen, with consequent damming back of contents; (d) hardened fecal concretions. The mal-placed, ill-rotated or retrocaecal type, because of these congenital handicaps, will usually show one or more of the above features. When, therefore, the surgeon encounters, at operation, such an appendix, and when the carefully studied history substantiates the clinical findings, he may be more sure of his ground in promising relief. But if, on the other hand, none of these comforting manifestations are present, but the impeached appendix is found floating hither and thither within the cavity, it would be well for him to look further for the cause of the complaint.

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